

National Bureau of Standards
Library, N.W. Bldg
AUG 1 1960

CRPL-F 191 PART A

FOR OFFICIAL USE

Reference book not to be
taken from the library.

PART A
IONOSPHERIC DATA

ISSUED
JULY 1960

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
CENTRAL RADIO PROPAGATION LABORATORY
BOULDER, COLORADO

IONOSPHERIC DATA

CONTENTS

	<u>Page</u>
Symbols, Terminology, Conventions	ii
World-Wide Sources of Ionospheric Data.	v
Tabulations of Electron Density Data.	vii
Tables of Ionospheric Data.	1
Graphs of Ionospheric Data.	13
Index of Tables and Graphs of Ionospheric Data in CRPL-F191 (Part A)	49

SYMBOLS, TERMINOLOGY, CONVENTIONS

Beginning with data reported for January 1952, and continuing through December 1956, the symbols, terminology, and conventions for the determination of median values used in this report (CRPL-F series) conform as far as practicable to those adopted at the Sixth Meeting of the International Radio Consultative Committee (C.C.I.R.) in Geneva, 1951. Excerpts concerning symbols and terminology from Document No. 626-E of this Meeting are given on pages 2-7 of the report CRPL-F89, "Ionospheric Data," issued January 1952. Reprints of these pages are available upon request.

Beginning with data for January 1957, the symbols used are given in NBS Report 5033, "Summary of Changes in Ionospheric Vertical Soundings, Observing and Scaling Procedures - Effective 1 January 1957," which draws upon the First Report of the Special Committee on World-Wide Ionospheric Soundings (URSI/AGI), Brussels, Sept. 2, 1956. A list of these symbols is available upon request.

In the Second Report of the Special Committee on World-Wide Ionospheric Soundings of the URSI/AGI Committee, May 1957, a new descriptive letter was introduced:

- M Measurement questionable because the ordinary and extraordinary components are not distinguishable.

There was an expansion in meaning of the following:

- Z (1) (qualifying letter) Measurement deduced from the third magnetoionic component.
 (2) (descriptive letter) Third magnetoionic component present.

Beginning with data for January 1945, median values are published wherever possible. Where averages are reported, they are, at any hour, the average for all the days during the month for which numerical data exist.

The following conventions are used in determining the medians for hours when no measured values are given because of equipment limitations and ionospheric irregularities. Symbols used are those given above.

- a. For all ionospheric characteristics:

Values missing because of A, C, F, H, L, N or R are omitted from the median count.

b. For critical frequencies and virtual heights:

Values of foF2 (and foE near sunrise and sunset) missing because of E are counted as equal to or less than the lower limit of the recorder. Values of h'F (and h'E near sunrise and sunset) missing for this reason are counted usually as equal to or greater than the median. Other characteristics missing because of E are omitted from the median count.

Values missing because of G are counted:

1. For foF2, as equal to or less than foF1.
2. For h'F2, as equal to or greater than the median.

The symbol W is included in the median count only when it replaces a height characteristic; the descriptive symbol D, only when it replaces a frequency characteristic.

Values missing for any other reason are omitted from the median count.

c. For MUF factor (M-factors):

Values missing because of G or W are counted as equal to or less than the median.

Values missing for any other reason are omitted from the median count.

d. For sporadic E (Es):

Values of fEs missing because of E or G are counted as equal to or less than the median foE, or equal to or less than the lower frequency limit of the recorder.

B for fEs is counted on the low side when there is a numerical value of a higher layer characteristic; otherwise it is omitted from the median count.

S for fEs is counted on the low side at night; during the day it is omitted from the median count (beginning with data for November 1957).

Values of fEs missing for any other reason, and values of h'Es missing for any reason at all are omitted from the median count.

Beginning with CRPL-F188, Part A, issued April 1960, the count is given for foF2 in the tables of medians. It is regretted that space limitations prevent including detailed counts for other characteristics.

WORLD - WIDE SOURCES OF IONOSPHERIC DATA

The ionospheric data given here in tables 1 to 72 and figures 1 to 144 were assembled by the Central Radio Propagation Laboratory for analysis and correlation, incidental to CRPL prediction of radio propagation conditions. The data are median values unless otherwise indicated. The following are the sources of the data in this issue:

Republica Argentina, Ministerio de Marina:

Buenos Aires, Argentina
La Quiaca, Argentina
Trelew, Argentina
Ushuaia, Argentina

Commonwealth of Australia, Ionospheric Prediction Service of
the Commonwealth Observatory:

Brisbane, Australia

Meteorological Service of the Belgian Congo and Ruanda-Urundi:

Bunia, Belgian Congo
Elisabethville, Belgian Congo
Leopoldville, Belgian Congo

Belgian Royal Meteorological Institute:

Lwiro (Central African Institute for Scientific Research)

British Department of Scientific and Industrial Research, Radio
Research Board:

Falkland Is.
Ibadan, Nigeria (University College of Ibadan)
Inverness, Scotland
Port Lockroy
Singapore, British Malaya
Slough, England

Defence Research Board, Canada:

Alert, Canada
Resolute Bay, Canada
Victoria, Canada

Radio Wave Research Laboratories, National Taiwan University,
Taipeh, Formosa, China:

Formosa, China

Danish National Committee of URSI:

Narsarssuak, Greenland

General Direction of Posts and Telegraphs, Helsinki, Finland:
Nurmijarvi, Finland

The Finnish Academy of Sciences and Letters:
Sodankyla, Finland

The Royal Netherlands Meteorological Institute:
De Bilt, Holland

Central Institute of Meteorology, Budapest, Hungary:
Budapest, Hungary

Indian Council of Scientific and Industrial Research, Radio Research Committee,
New Delhi, India:

Ahmedabad (Physical Research Laboratory)
Bombay (All India Radio)
Calcutta (Institute of Radio Physics and Electronics)
Delhi (All India Radio)
Kodaikanal (India Meteorological Department)
Madras (All India Radio)
Tiruchy (All India Radio)
Trivandrum (All India Radio)

General Directorate of Telecommunications, Mexico:
El Cerillo, Mexico

Telecommunication Administration, Oslo, Norway:
Svalbard, Norway

Institute of Terrestrial Magnetism, Ionosphere and Radio Propagation, Moscow,
U.S.S.R.:
Moscow
Providenie Bay
Simferopol

Research Institute of National Defence, Stockholm, Sweden:
Lycksele, Sweden
Upsala, Sweden

Royal Board of Swedish Telegraphs, Radio Department, Stockholm, Sweden:
Lulea, Sweden

United States Army Signal Corps:
Grand Bahama I.
Okinawa I.
Thule, Greenland
White Sands, New Mexico

National Bureau of Standards (Central Radio Propagation Laboratory):
Byrd Station, Antarctica
Huancayo, Peru (Instituto Geofisico de Huancayo)
Pole Station, Antarctica
Talara, Peru (Instituto Geofisico de Huancayo)
Washington, D. C.

TABULATIONS OF ELECTRON DENSITY DATA

Reduction of hourly ionospheric vertical soundings to electron density profiles has become a part of the systematic ionospheric data program of the Central Radio Propagation Laboratory, National Bureau of Standards. Scalings of ionograms for this purpose are being provided by ionosphere stations operated by CRPL and the U. S. Army Signal Corps. For the present, the hourly profile data from one CRPL station, Puerto Rico, are appearing in the monthly CRPL-F Reports, Part A. These data are in place of the standard ionogram reductions formerly provided by this Station. The very considerable task of scaling the ionograms for this purpose is being undertaken by T. R. Gilliland, Engineer in Charge, Puerto Rico Ionosphere Sounding Station; the computations are performed at the NBS Boulder Laboratories by a group headed by J. W. Wright. Basic conversion of virtual to true heights uses the well-known matrix method developed by K. G. Budden of the Cavendish Laboratory, Cambridge University, programmed for an IBM 704 computer.

The tabulations provide the following basic electron density profile data for each hour of each day of the month:

<u>Quantity</u>	<u>Units</u>	<u>Remarks</u>
Electron Density (N)	$\times 10^3 = \text{electrons/cm}^3$	Body of table; given at each 10 km of height.
NMAX	$\times 10^3 = \text{electrons/cm}^3$	Always the highest value of N at each hour. To maintain this rule, the electron density at the next 10 km increment above HMAX is always given as exactly equal to NMAX (unless HMAX coincides with a 10 km level).
QUALification	(Alphabetic)	A standard scaling letter qualifying the observation when necessary.
HMIN	Kilometers	The height of zero or very low electron density, obtained by linear extrapolation of the electron density vs. height curve.
SCAT	Kilometers	One half of the half-thickness of the parabola best fitting the upper portion of the F region profile. Approximates the scale height near the level HMAX.
HMAX	Kilometers	The height of maximum electron density, determined by fitting a parabola to the upper portion of the profile.
SHMAX	$\times 10^{10} = \text{electrons/cm}^2$ column.	Obtained by integration of the profile between the limits HMIN and HMAX.

Tabulations of the average electron densities each hour, at each 10 km level, for the quiet ionosphere, are also given. These averages include the profiles obtained when the magnetic character figure Kp is less than 4+. The number of profiles entering the average for each hour is given by CNT. The other parameters of the layer, HMIN, SCAT, HMAX, SHMAX, are averaged in a similar way.

Before the averaging process, the individual profiles are extrapolated above HMAX by a Chapman distribution of 100 km scale height. This assumed model seems to agree well with the few published measurements dealing with the topside profile of the F-region.* Extrapolation is necessary in order to calculate homogeneous averages near HMAX and the average profiles are, in fact, given up to 950 km. Also given are the average estimated integrated electron densities to infinity, SHINF (same units as SHMAX); this is an approximation to the total electron content in a column of the ionosphere.

*See Wright, J.W. "A Model of the F-Region Above HMAX F2" J.Geophys.Res. V.65 pp 185-191.

ELECTRON DENSITY

	PUERTO RICO				60 W				5 MAR 1960			
TIME	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
QUAL	S											
HMIN	110		110	108	109	109	228	211	183	213	238	228
SCAT	52+6		55+4	54+5	48+1	54+4	58+0	40+7	51+8	50+7	50+3	48+9
HMAX	320		321	325	315	320	332	295	306	347	373	344
SKM	2178		2128	2101	1870	1979	1698	1107	812	589	525	482
SHX												
380											716	
370											716	
360											704	
350										804	679	726
340										800	633	724
330	2465		2294	2277		2327	2361				782	585
320	2465		2293	2273	2210	2327	2338				747	521
310	2463		2269	2236	2203	2308	2280		1072		697	446
300	2376		2207	2161	2151	2250	2186	2063	1069	634	362	573
290	2262		2106	2044	2041	2151	2063	2054	1048	559	278	495
280	2108		1974	1896	1907	2013	1907	1989	1004	477	192	395
270	1907		1798	1706	1730	1836	1669	1857	941	379	127	293
260	1669		1596	1496	1544	1625	1404	1469	864	278	81+8	109
250	1408		1395	1280	1341	1393	1050	1416	769	187	49+6	127
240	1156		1173	1096	1116	1122	477	1096	667	118	12+4	56+6
230	931		960	898	917	887	60+0	679	561	71+4	12+4	
220	754		794	731	728	679		240	456	40+2		
210	624		650	596	589	508						
200	524		535	498	477	404			343			
190	446		453	424	389	320			97+2			
180	389		389	365	322	255						
170	343		335	316	271	207						
160	302		291	272	231	171						
150	262		249	230	198	143						
140	219		209	194	168	122						
130	195		178	166	143	109						
120	183		167	153	133	102						
110	49+6		49+6	127	97+2	71+4						

ELECTRON DENSITY

[illegible]

ELECTRON DENSITY

	PUERTO RICO				60 W				21 MAR				1960
TIME	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
QUAL													
HMIN	108	109	108	105	105	108	229	216	197	189	207	247	
HMAX	5741	5544	6141	4943	5740	5849	4842	4142	4946	6049	4244	4449	
SMAX	1895	2037	2313	1946	2034	2105	1476	1165	1009	798	489	454	
KM													
360												726	
350												722	
340											764	701	
330											764	661	
320	1907	2177	2286	2260	2227	2250	2430			1016	754	608	
310	1901	2168	2284	2256	2208	2199	2384		1528	1014	723	529	
300	1868	2125	2181	2214	2155	2039	2294	2193	1527	1000	667	437	
290	1805	2047	2075	2117	2068	1961	2137	2172	1503	973	598	328	
280	1706	1926	1948	1978	1945	1799	1937	2086	1449	930	514	219	
270	1583	1786	1786	1807	1786	1600	1669	1935	1363	875	417	127	
260	1446	1602	1612	1606	1604	1383	1240	1722	1248	807	323	714	
250	1289	1407	1418	1376	1391	1127	754	1418	1096	716	228	2043	
240	1134	1192	1213	1127	1173	901	286	1004	917	608	149		
230	974	1023	1023	929	960	702	4042	508	716	477	9043		
220	834	802	848	754	755	593		143	431	335	5641		
210	716	659	700	608	592	446			179	179	1854		
200	617	552	596	508	477	362			4442	7144			
190	535	477	508	434	393	301				1244			
180	462	417	434	377	330	252							
170	398	373	376	329	281	210							
160	346	333	328	286	243	174							
150	305	290	291	249	212	143							
140	265	266	253	214	186	122							
130	223	225	223	186	164	109							
120	193	192	193	172	149	103							
110	143	9742	143	162	8348	8348							

ELECTRON DENSITY

	PUERTO RICO				60 W				22 MAR				1960
TIME	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
OVAL			5										
HMIN	109	109	108	106	108	109	223	209	189	189	228	250	
SCAT	64.0	60.8	57.7	57.6	56.7	59.7	46.0	46.9	46.3	66.7	52.5	53.9	
HMAXF	316	315	330	320	329	323	324	315	316	363	366	374	
SHMAX	1755	1813	1959	1884	1907	1810	1136	1111	795	875	607	609	
380												854	
370										917	804	853	
360										917	801	840	
350										908	786	813	
340										889	754	770	
330			1922							859	707	716	
320	1697	1801	1907	1984	1986	1967	1843	1771	1203	820	651	638	
310	1693	1797	1848	1969	1942	1966	1804	1767	1198	770	581	546	
300	1669	1712	1786	1924	1868	1896	1717	1728	1161	710	499	417	
290	1618	1723	1683	1841	1757	1819	1598	1646	1108	643	405	286	
280	1565	1646	1555	1737	1619	1711	1425	1528	1024	563	310	168	
270	1481	1549	1412	1605	1457	1580	1197	1371	908	477	223	94.4	
260	1370	1426	1251	1446	1275	1420	943	1165	767	389	143	51.9	
250	1240	1286	1096	1278	1096	1240	643	917	608	310	88.6		
240	1096	1143	948	1070	917	1050	335	608	446	240	52.5		
230	944	994	811	875	754	834	83.8	310	293	172	12.4		
220	794	834	668	716	614	643		112	179	112			
210	679	687	600	585	508	494		124.7	97.2	71.4			
200	565	573	523	485	434	389			53.7	47.6			
190	477	481	457	417	373	310			5.5	7.1			
180	414	417	399	362	322	253							
170	362	369	349	318	278	214							
160	324	329	308	278	240	182							
150	288	293	272	240	205	157							
140	251	258	234	206	177	137							
130	219	223	200	179	157	123							
120	194	194	185	169	145	113							
110	143	143	143	143	112	60.0							

Corrigendum

In the tabulations of average electron density profiles for Puerto Rico, February 1960 in the previous issue (CRPL-F 190 Part A), the average profiles for hours 1900-2300 were inadvertently omitted. The complete table of average profiles is given in this issue, following the average profiles for March 1960.

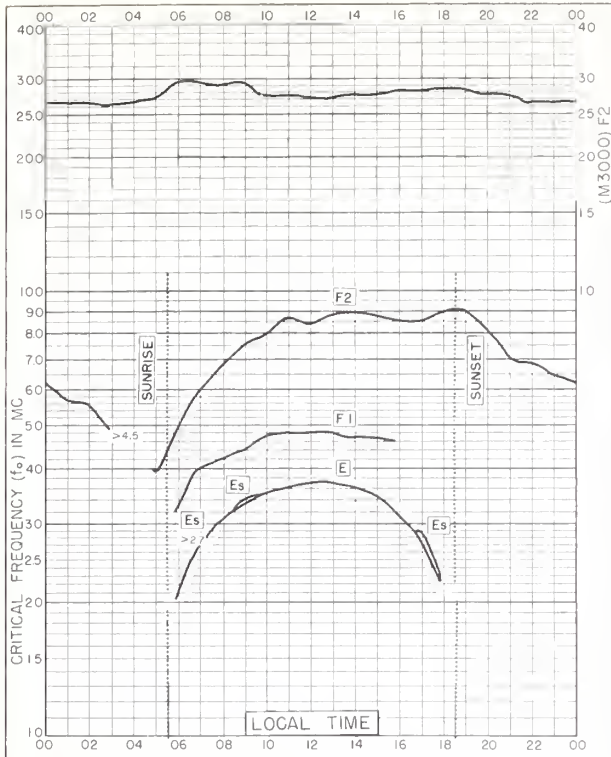


Fig. 1. WASHINGTON, D. C.
38.7°N, 77.1°W

APRIL 1960

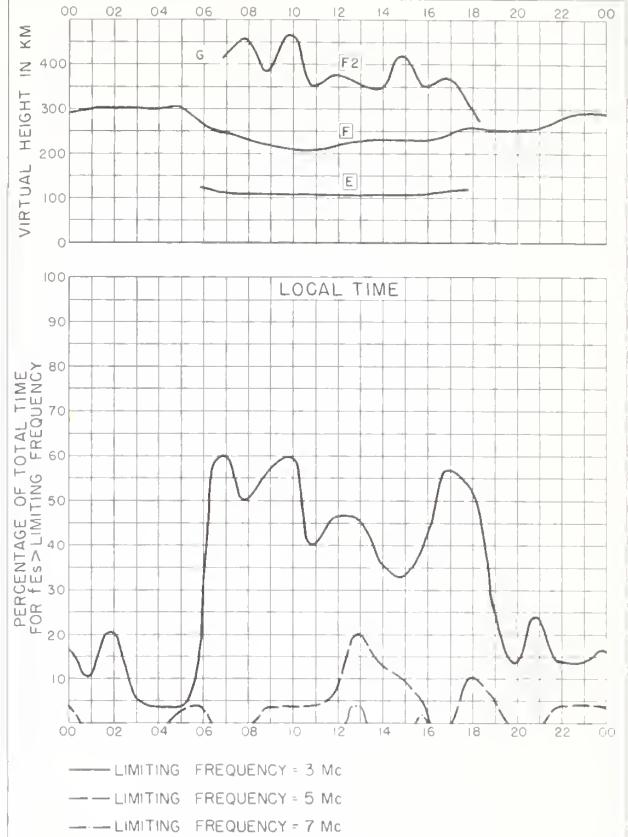


Fig. 2. WASHINGTON, D. C.

APRIL 1960

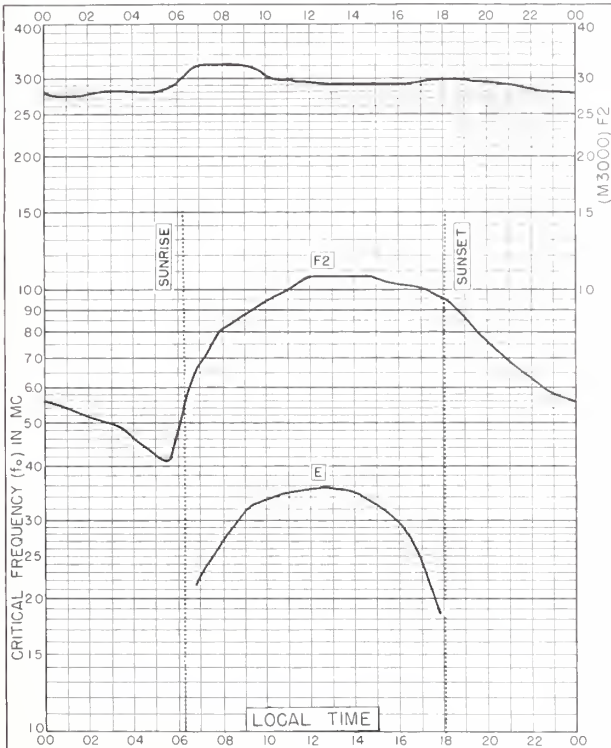


Fig. 3. WASHINGTON, D. C.
38.7°N, 77.1°W

MARCH 1960

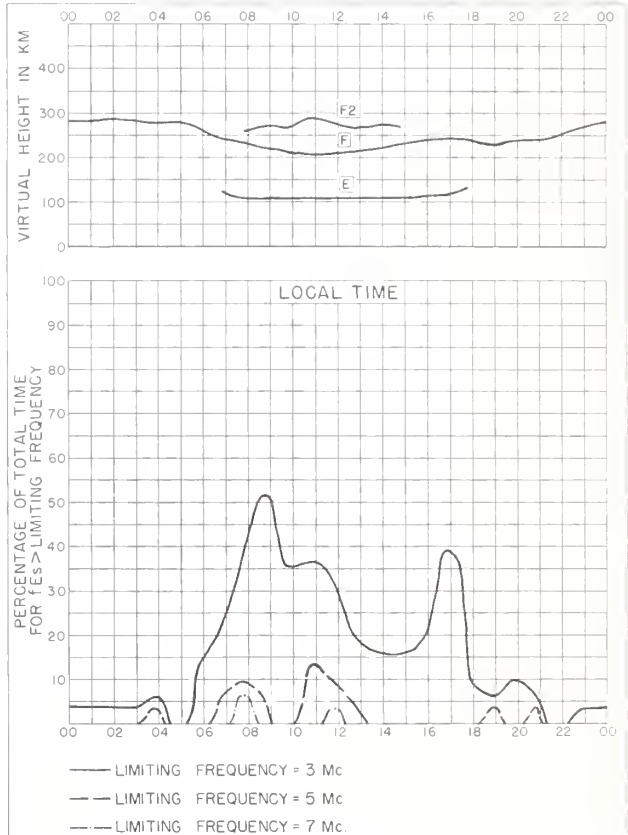


Fig. 4. WASHINGTON, D. C.

MARCH 1960



Fig. 5. HUANCAYO, PERU
12.0°S, 75.3°W

MARCH 1960

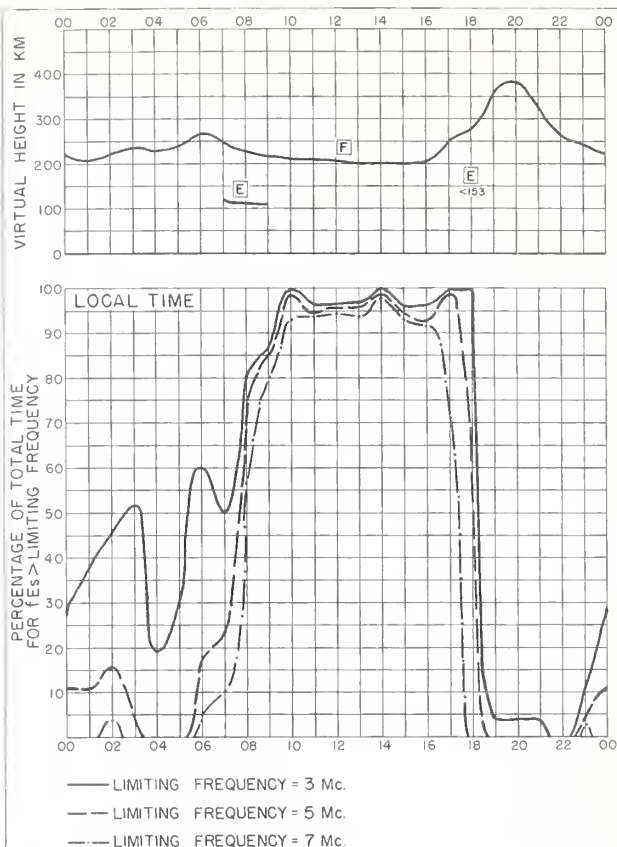


Fig. 6. HUANCAYO, PERU

MARCH 1960

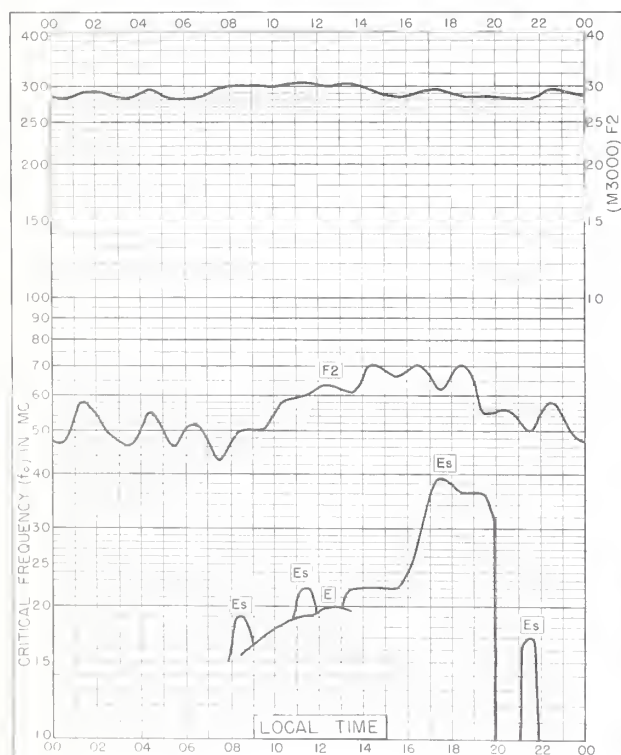


Fig. 7. THULE, GREENLAND
76.6°N, 68.7°W

FEBRUARY 1960

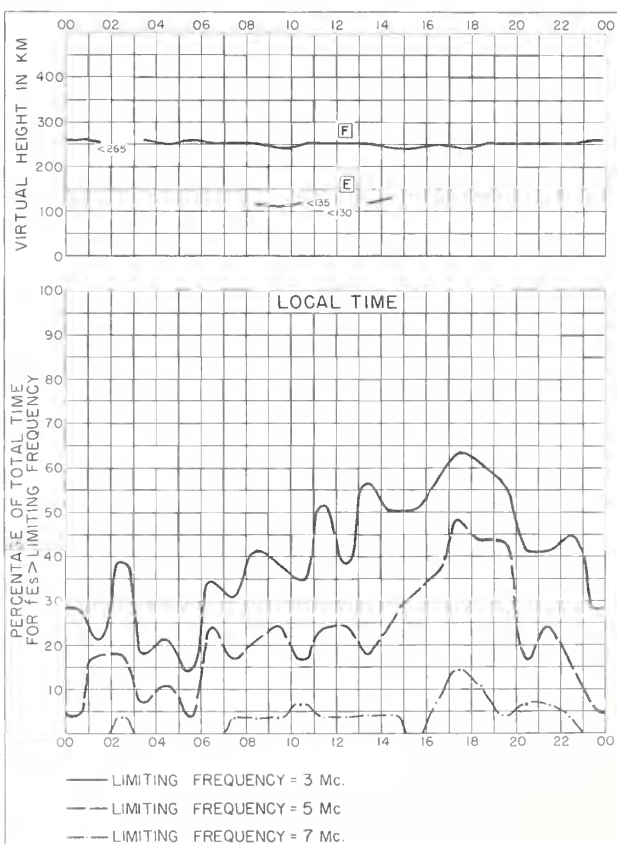


Fig. 8. THULE, GREENLAND FEBRUARY 1960

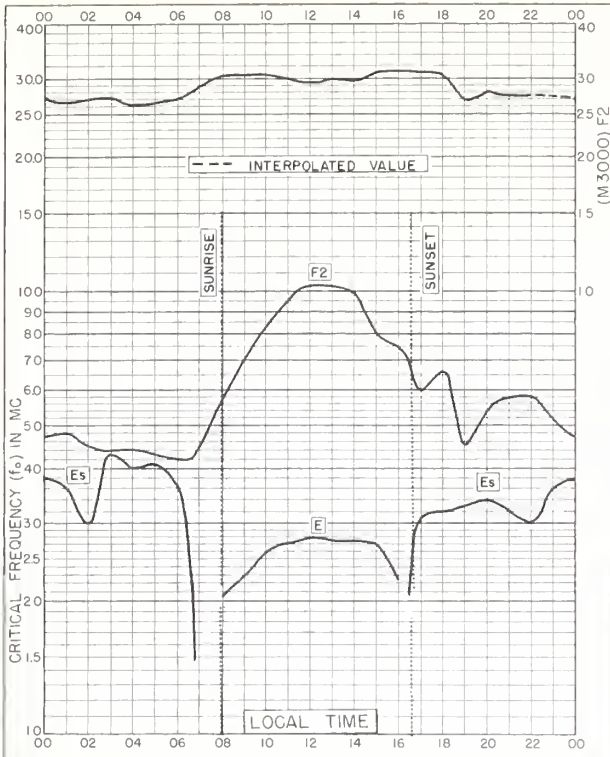


Fig. 9. NARSARSSUAK, GREENLAND
61.2°N, 45.4°W FEBRUARY 1960

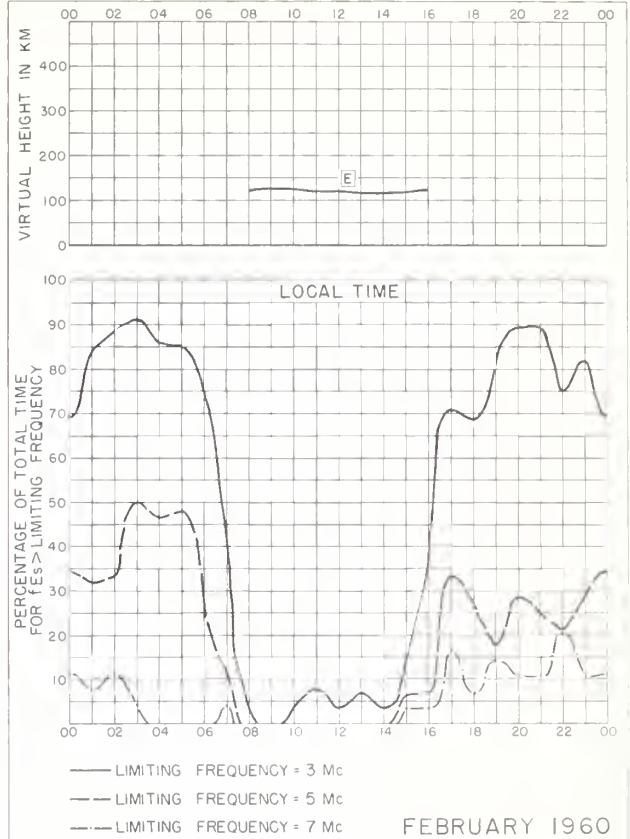


Fig. 10. NARSARSSUAK, GREENLAND

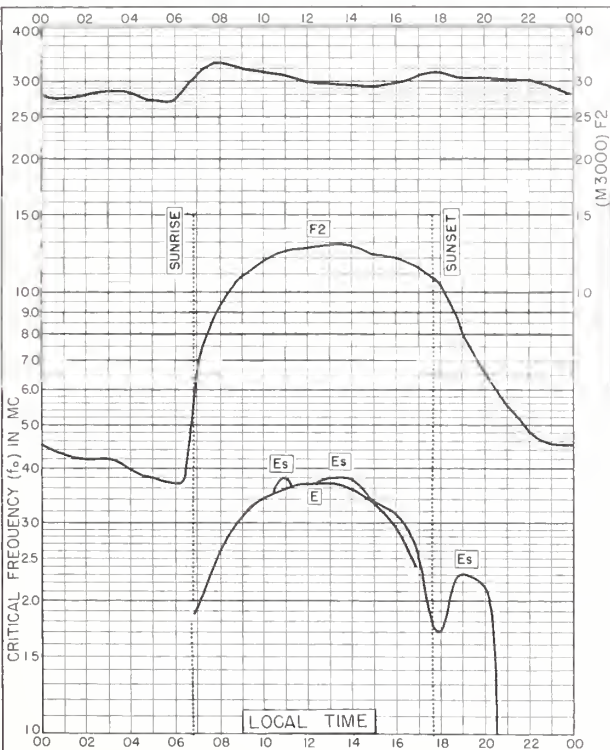


Fig. 11. WHITE SANDS, NEW MEXICO
32.3°N, 106.5°W FEBRUARY 1960

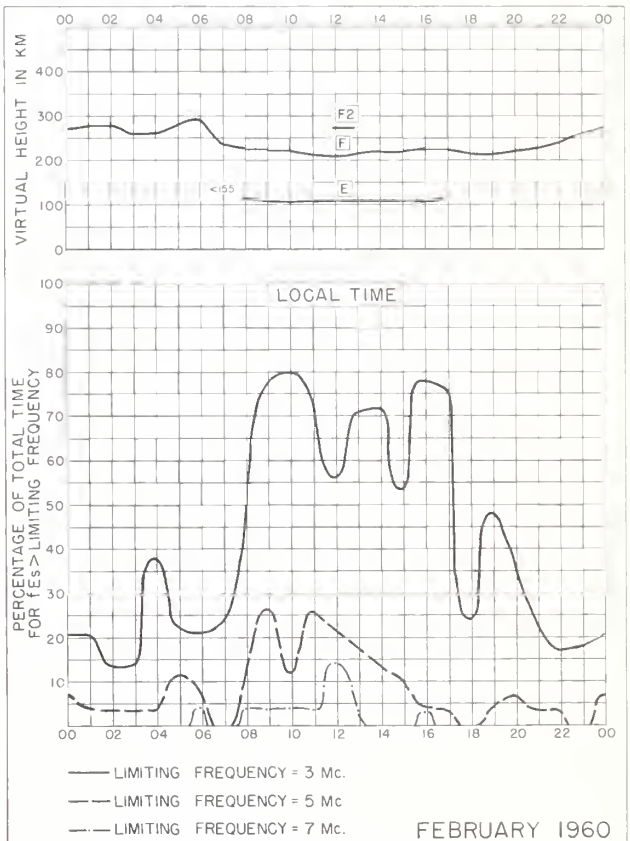


Fig. 12. WHITE SANDS, NEW MEXICO



Fig. 13. GRAND BAHAMA I
26.6°N, 78.2°W FEBRUARY 1960

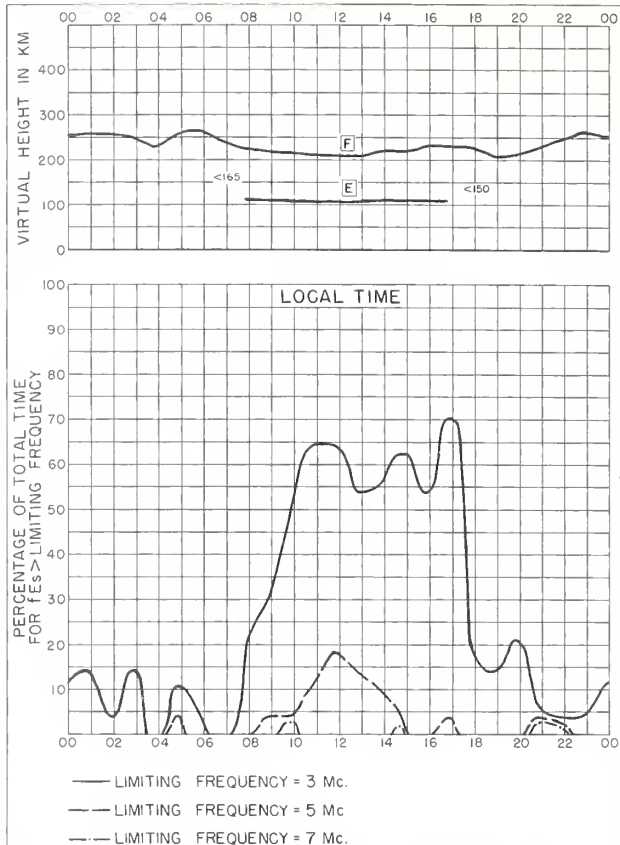


Fig. 14. GRAND BAHAMA I. FEBRUARY 1960

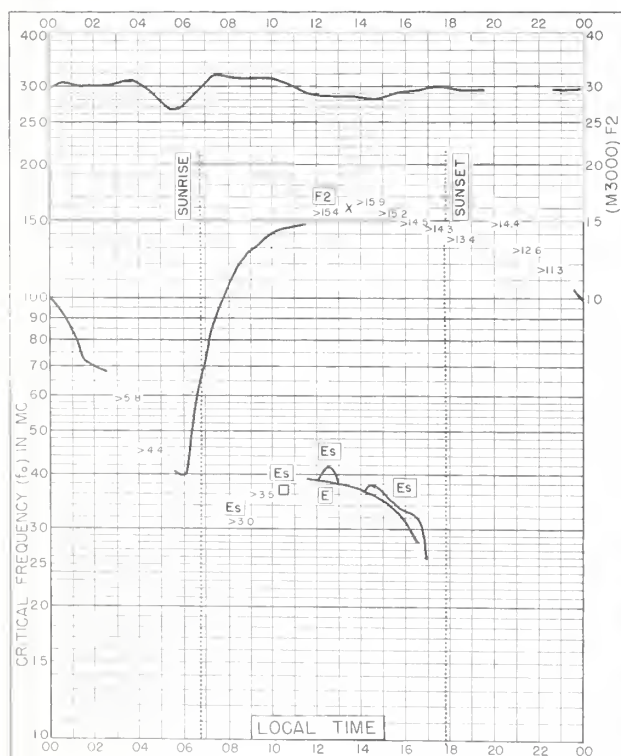


Fig. 15. OKINAWA I.
26.3°N, 127.8°E FEBRUARY 1960

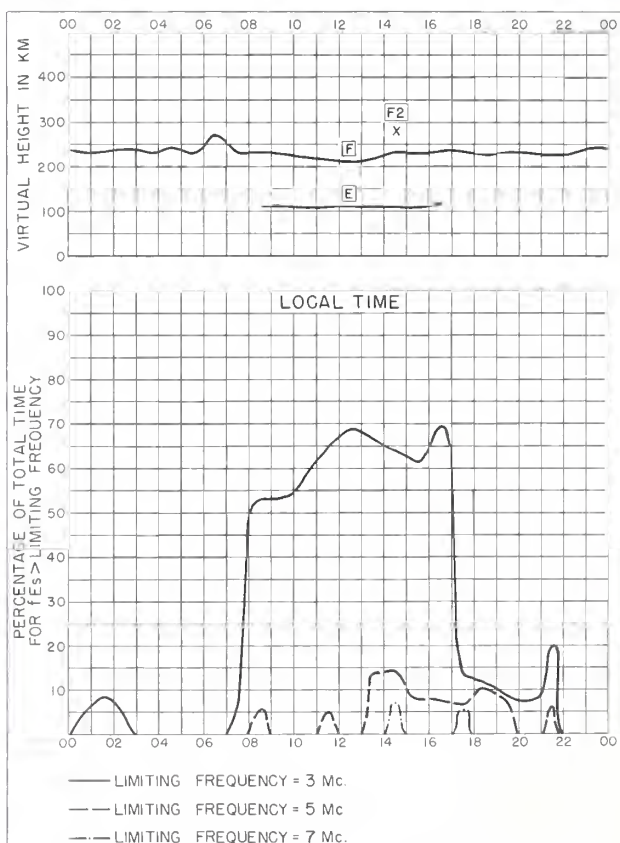


Fig. 16. OKINAWA I. FEBRUARY 1960

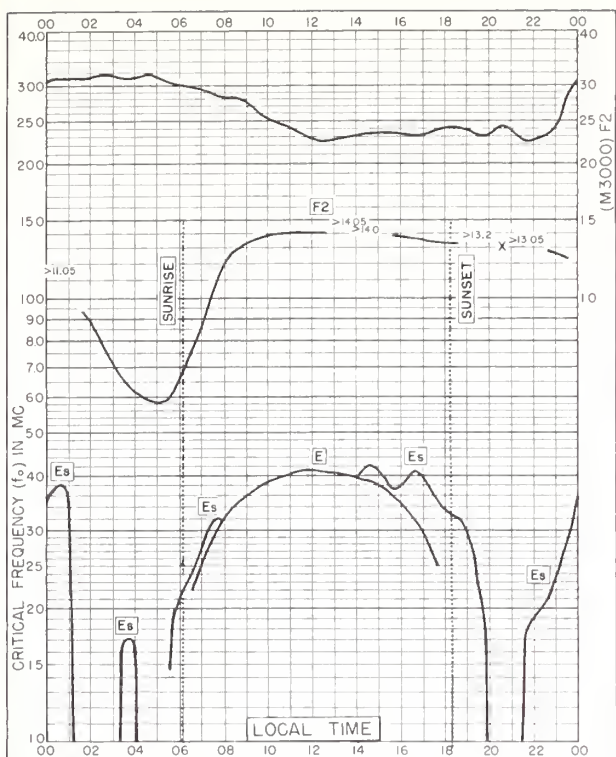


Fig. 17. TALARA, PERU

4.6°S, 81.3°W

FEBRUARY 1960

NBS 503

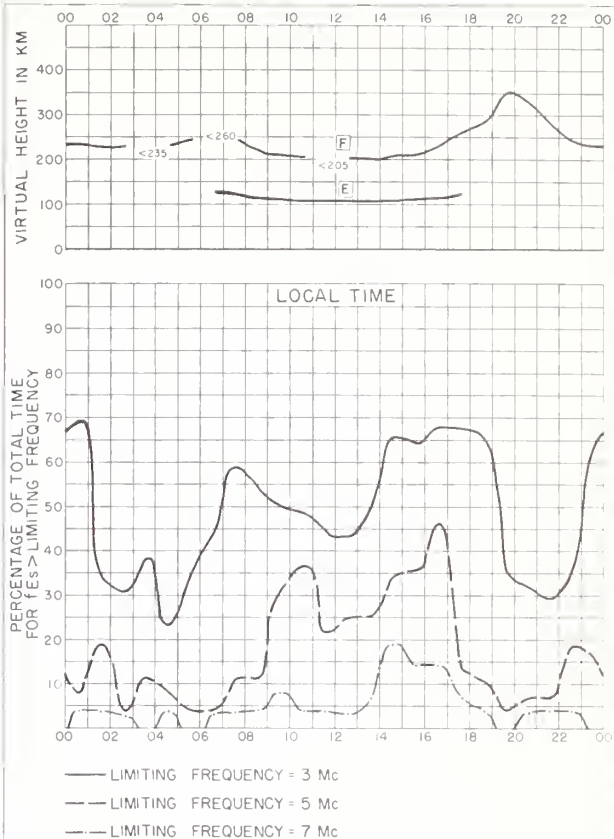


Fig. 18. TALARA, PERU

FEBRUARY 1960

NBS 490

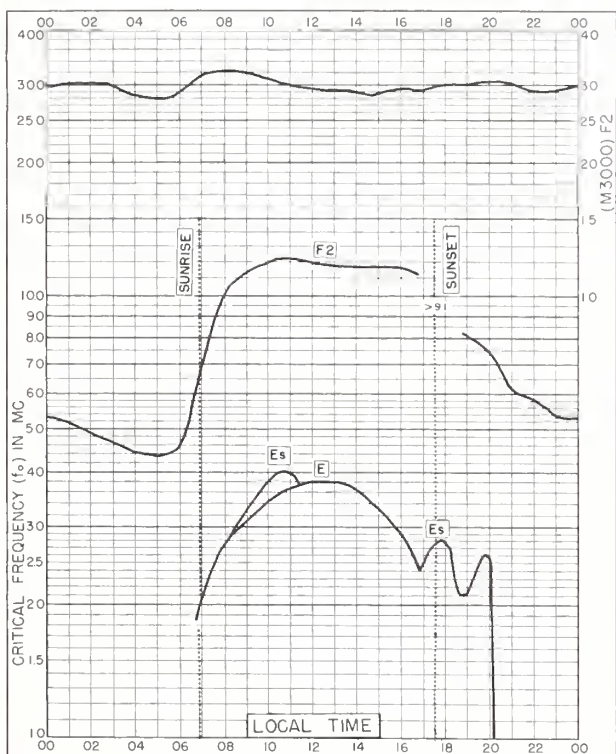


Fig. 19. GRAND BAHAMA I.

26.6°N, 78.2°W

JANUARY 1960

NBS 503

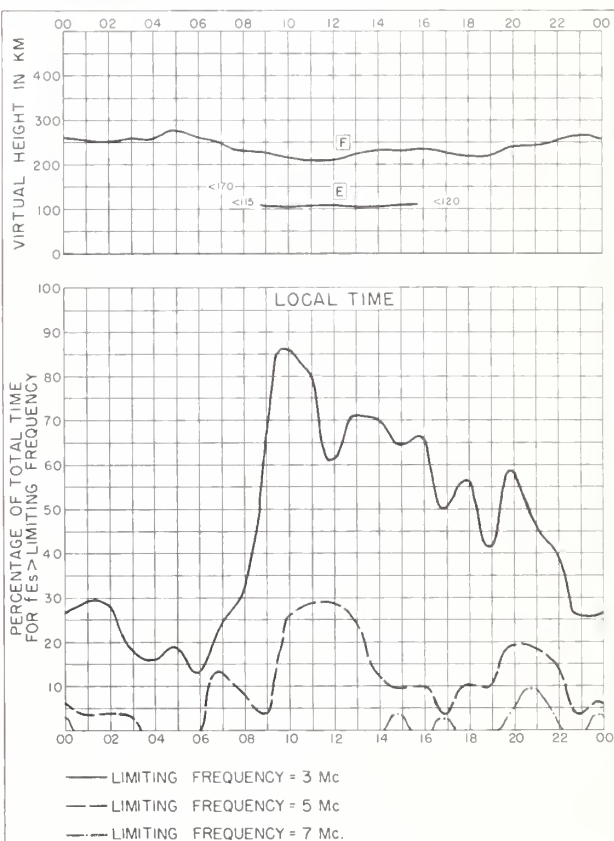


Fig. 20. GRAND BAHAMA I.

JANUARY 1960

NBS 490

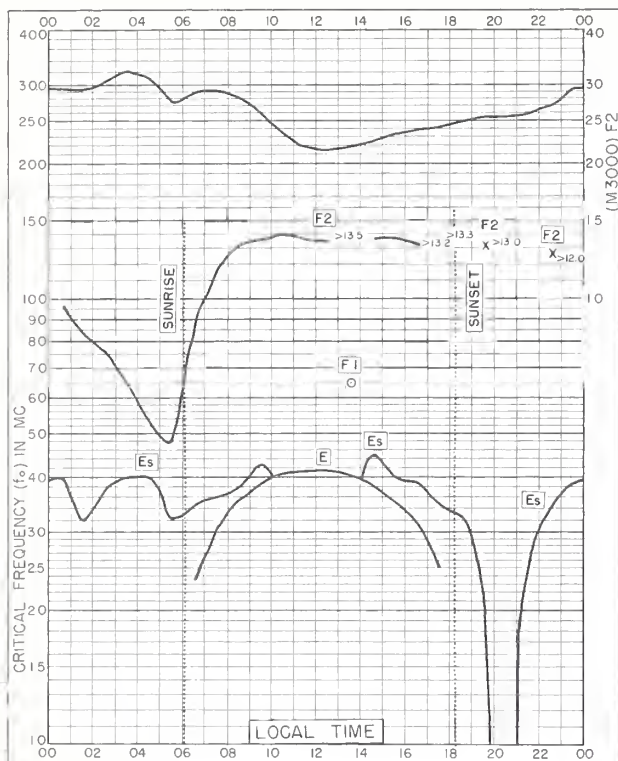


Fig. 21. TALARA, PERU
4.6°S, 81.3°W

JANUARY 1960

NBS 503

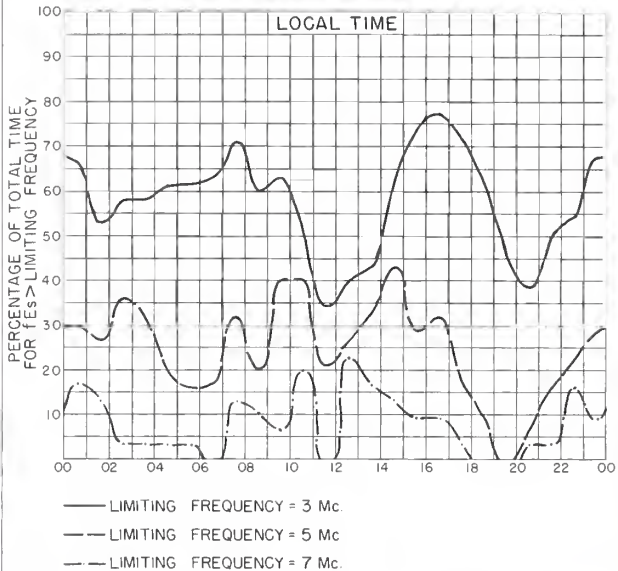
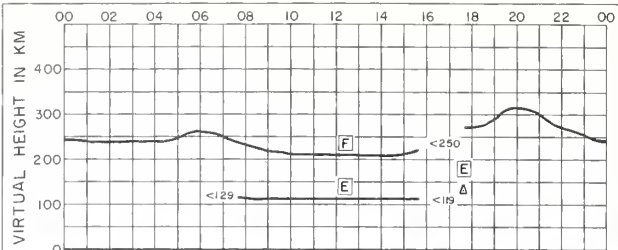


Fig. 22. TALARA, PERU

JANUARY 1960

NBS 490

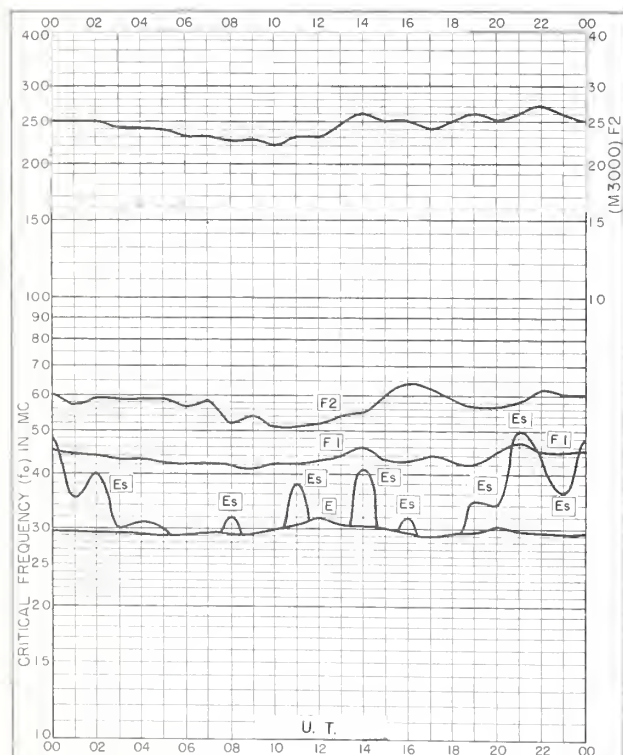


Fig. 23. POLE STATION
90.0°S

JANUARY 1960

NBS 503

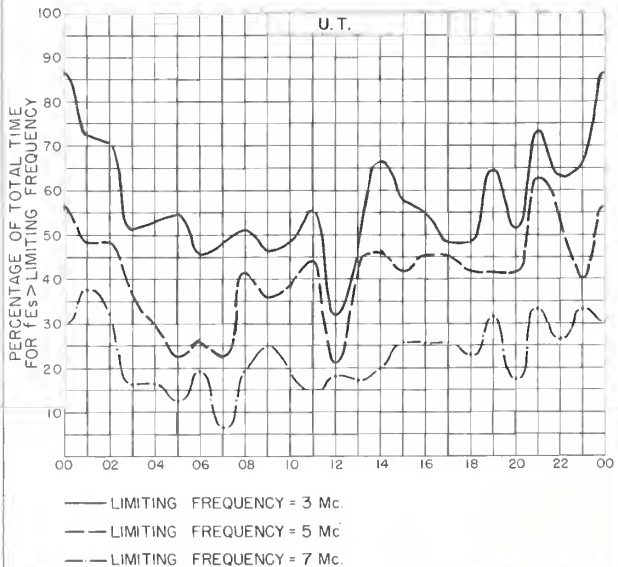
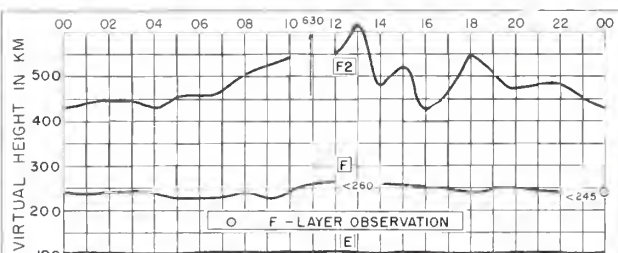


Fig. 24. POLE STATION

JANUARY 1960

NBS 490

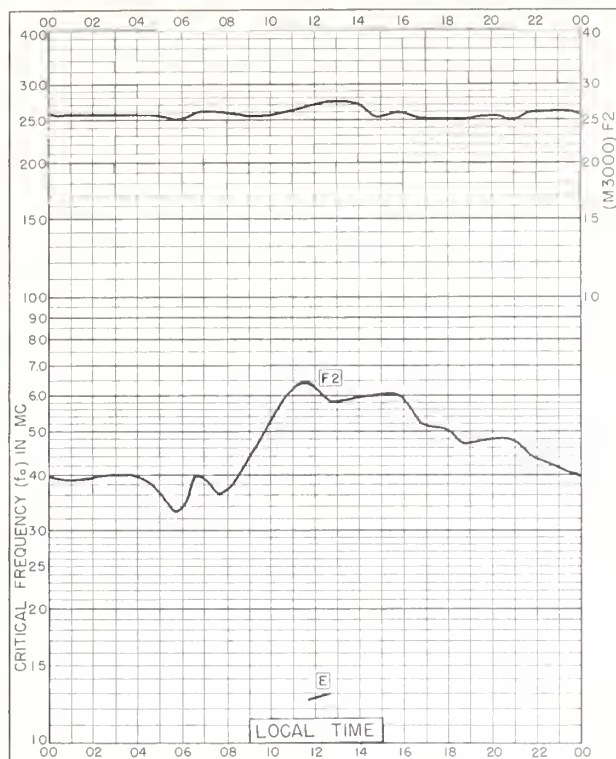


Fig. 25. RESOLUTE BAY, CANADA
74.7°N, 94.9°W DECEMBER 1959

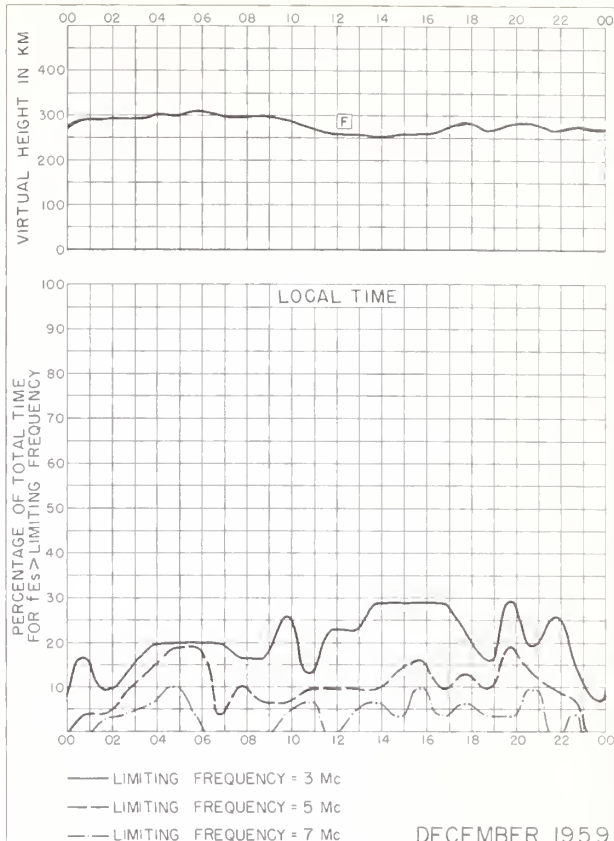


Fig. 26. RESOLUTE BAY, CANADA



Fig. 27. INVERNESS, SCOTLAND
57.4°N, 4.2°W DECEMBER 1959

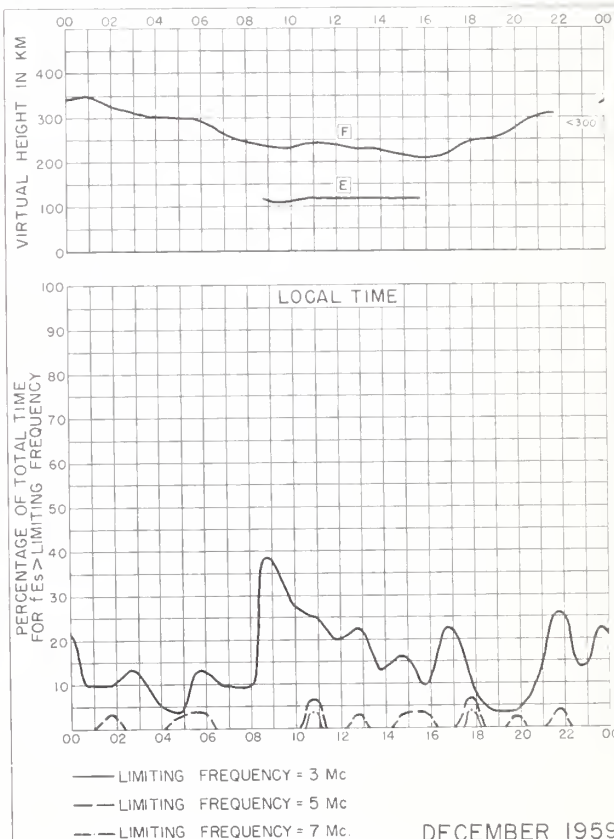


Fig. 28. INVERNESS, SCOTLAND

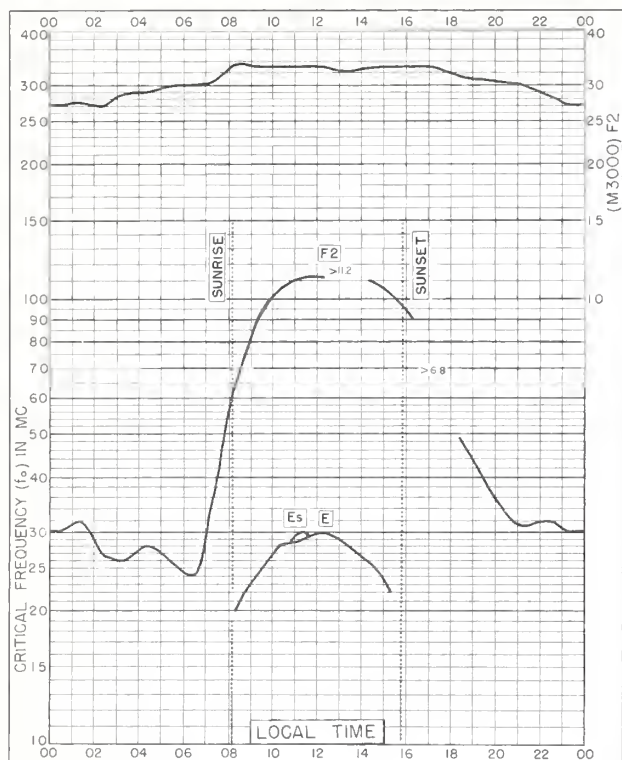


Fig. 29. De BILT, HOLLAND
52.1°N, 5.2°E

DECEMBER 1959

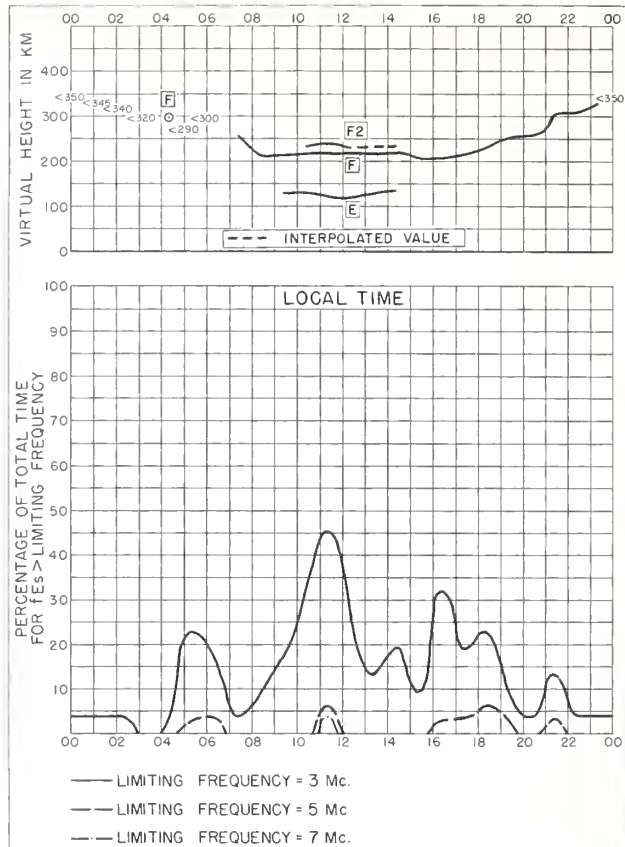


Fig. 30. De BILT, HOLLAND
DECEMBER 1959

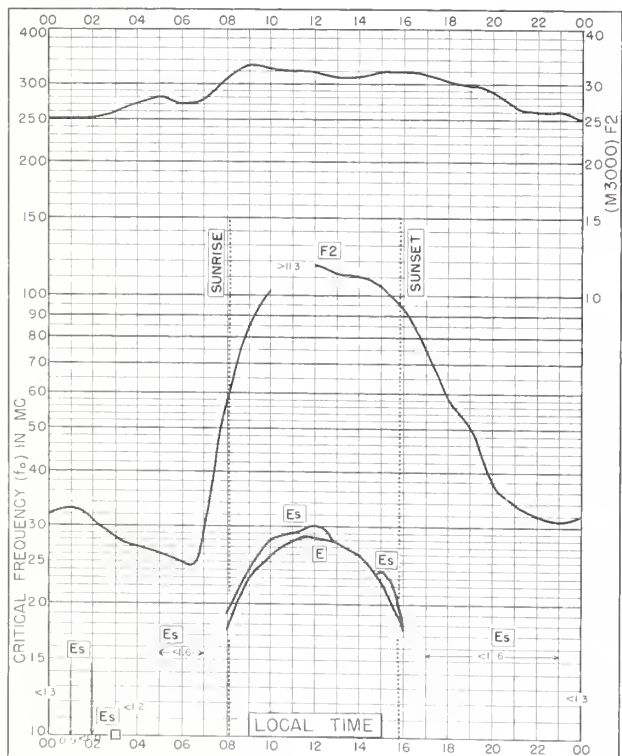


Fig. 31. SLOUGH, ENGLAND
51.5°N, 0.6°W

DECEMBER 1959

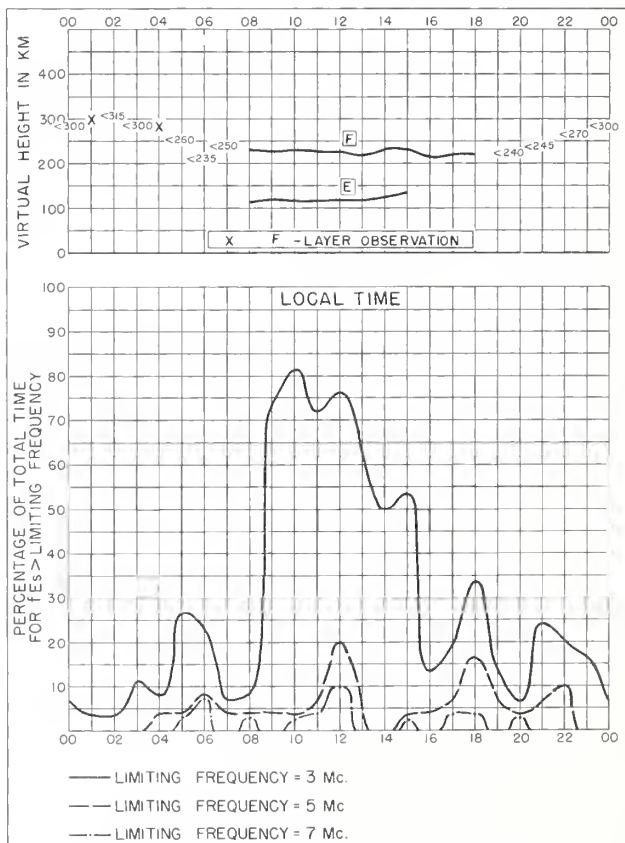


Fig. 32. SLOUGH, ENGLAND
DECEMBER 1959

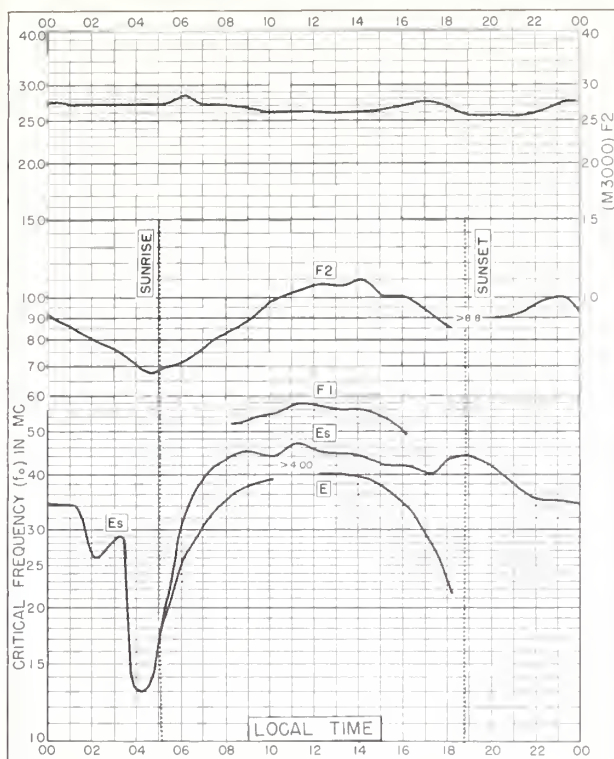


Fig. 33. BRISBANE, AUSTRALIA
27.5°S, 152.9°E DECEMBER 1959

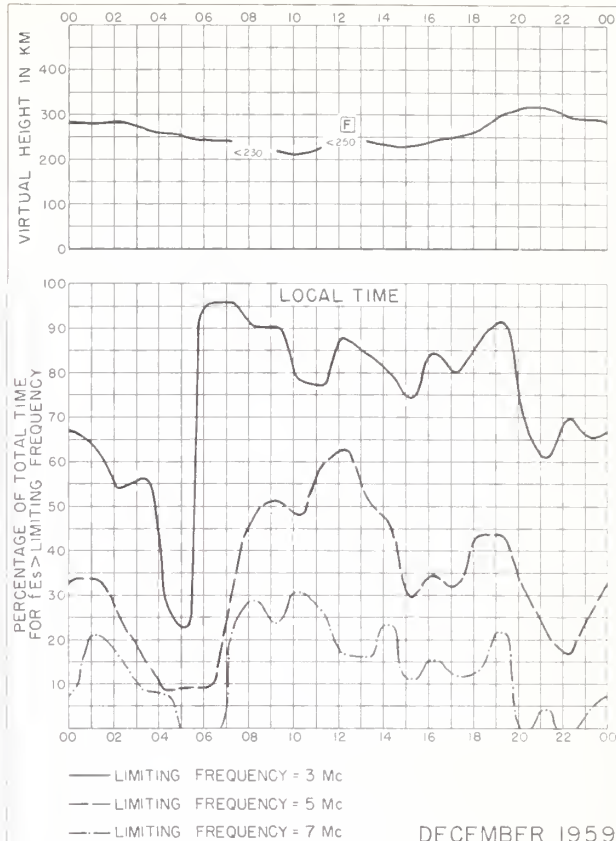


Fig. 34. BRISBANE, AUSTRALIA



Fig. 35. POLE STATION
90.0°S DECEMBER 1959

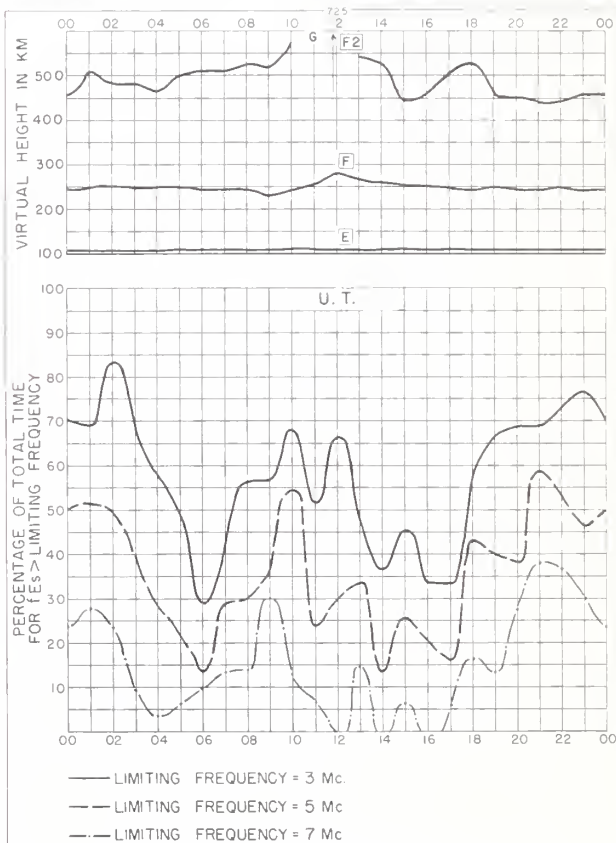


Fig. 36. POLE STATION DECEMBER 1959

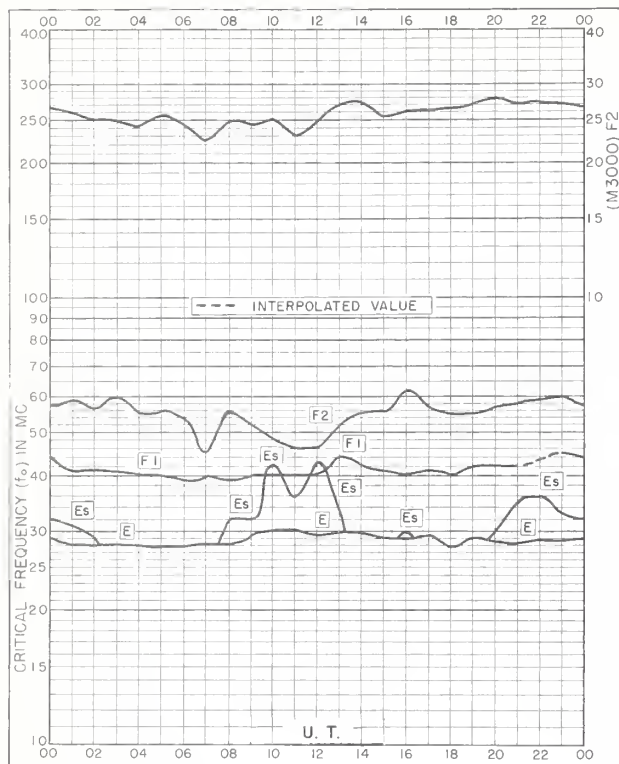


Fig. 37. POLE STATION
90.0°S

NOVEMBER 1959

NBS 503

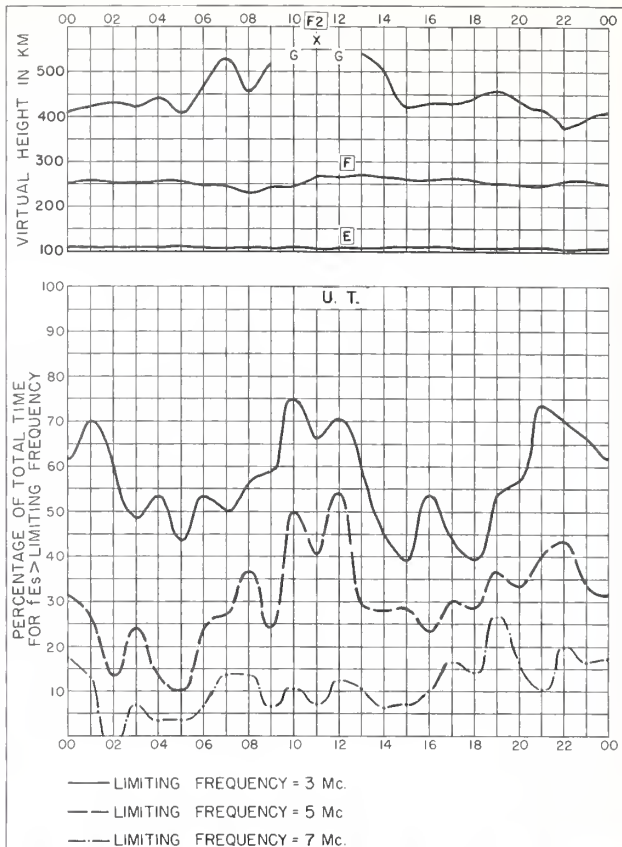


Fig. 38. POLE STATION

NOVEMBER 1959

NBS 490

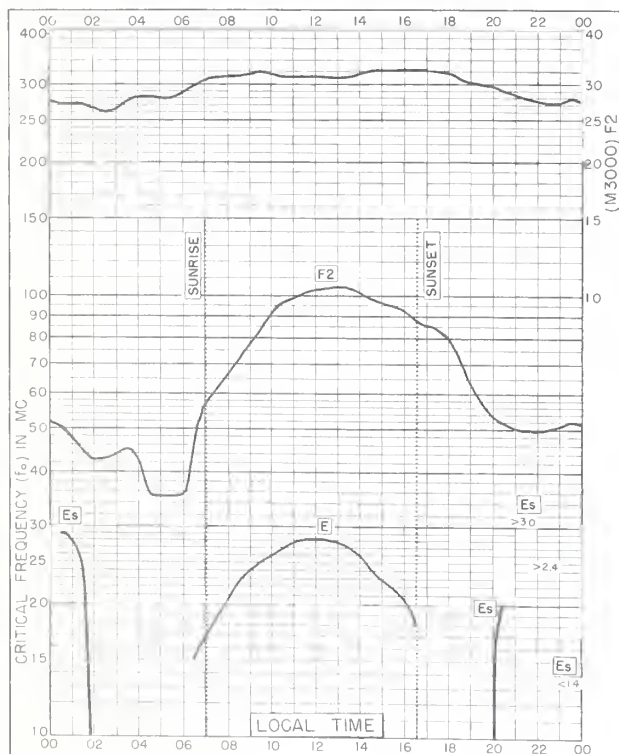


Fig. 39. LULEA, SWEDEN
65.6°N, 22.1°E

OCTOBER 1959

NBS 503

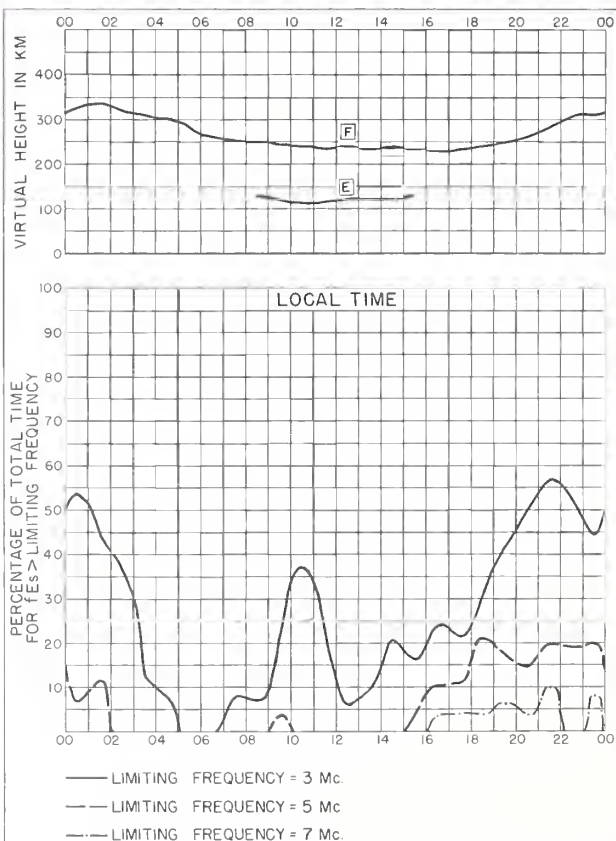


Fig. 40. LULEA, SWEDEN

OCTOBER 1959

NBS 490

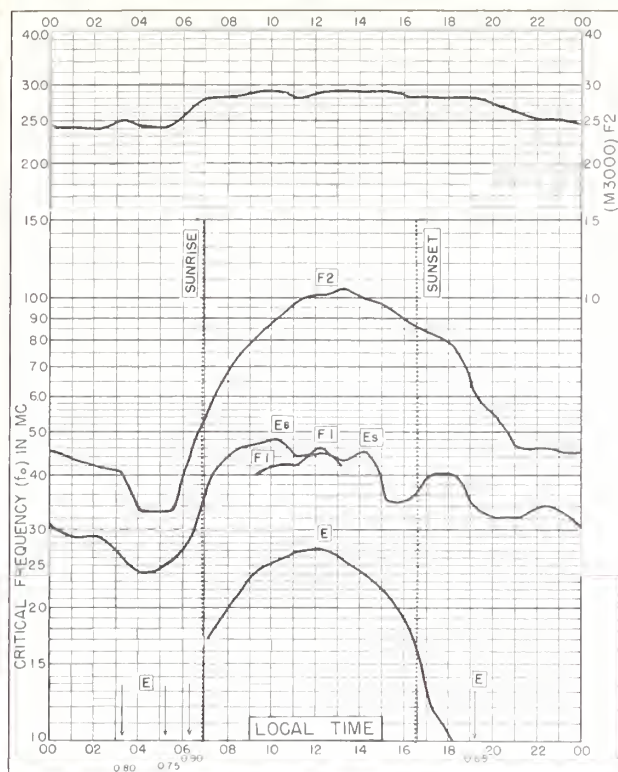


Fig. 41. LYCKSELE, SWEDEN
64.6°N, 18.8°E

OCTOBER 1959

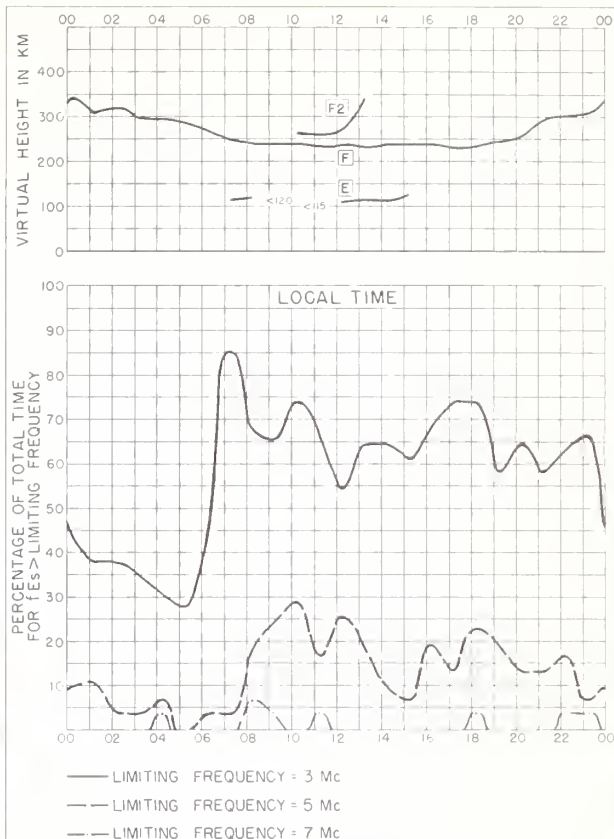


Fig. 42. LYCKSELE, SWEDEN

OCTOBER 1959

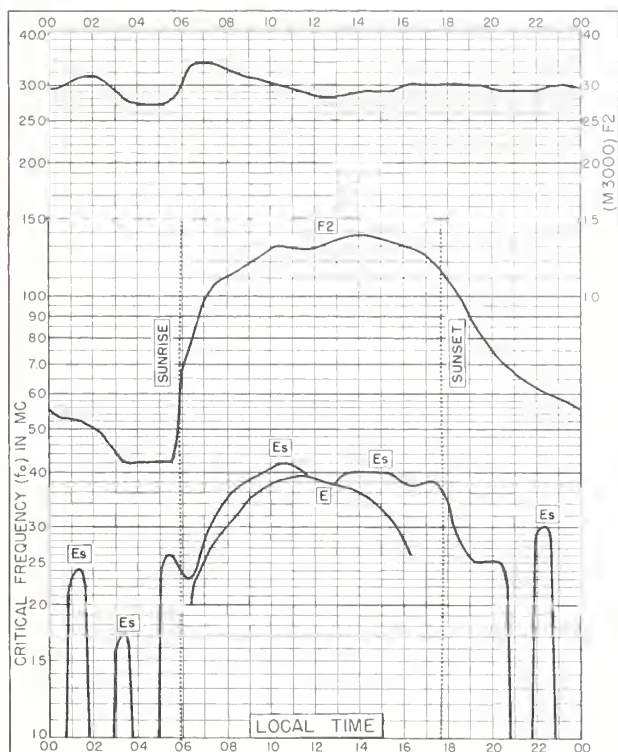


Fig. 43. EL CERILLO, MEXICO
19.3°N, 99.5°W

OCTOBER 1959

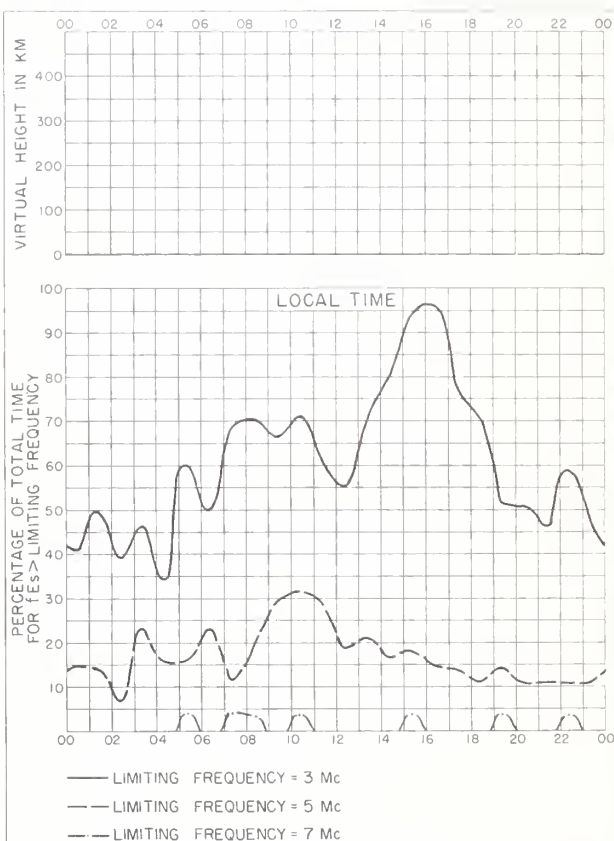
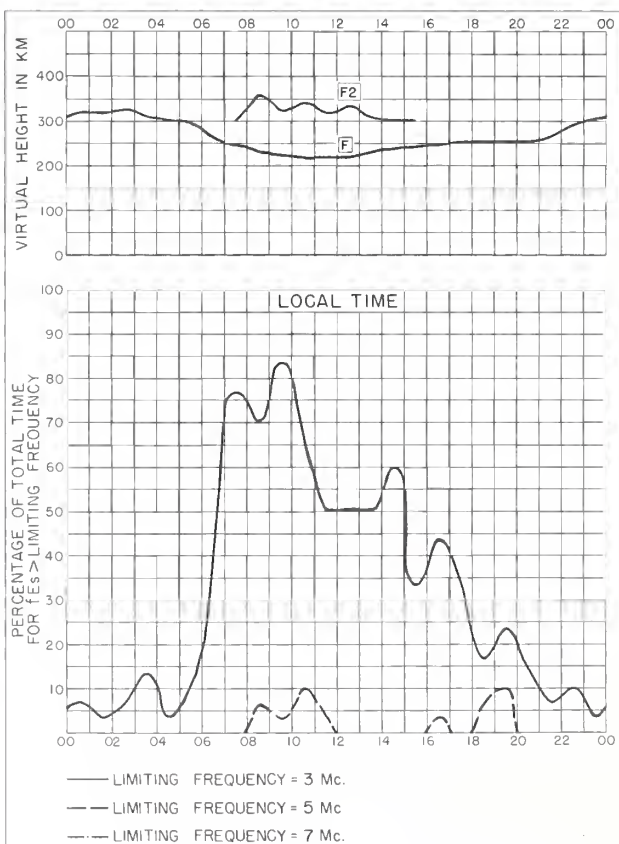
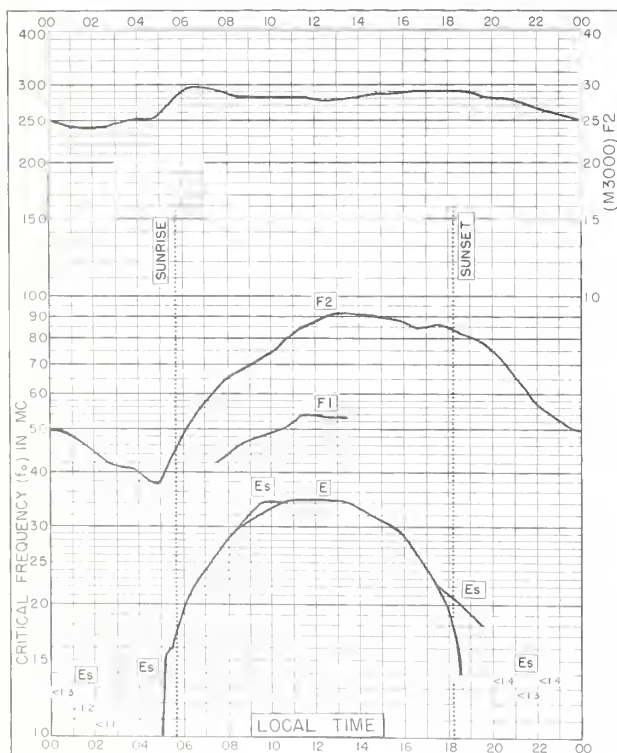
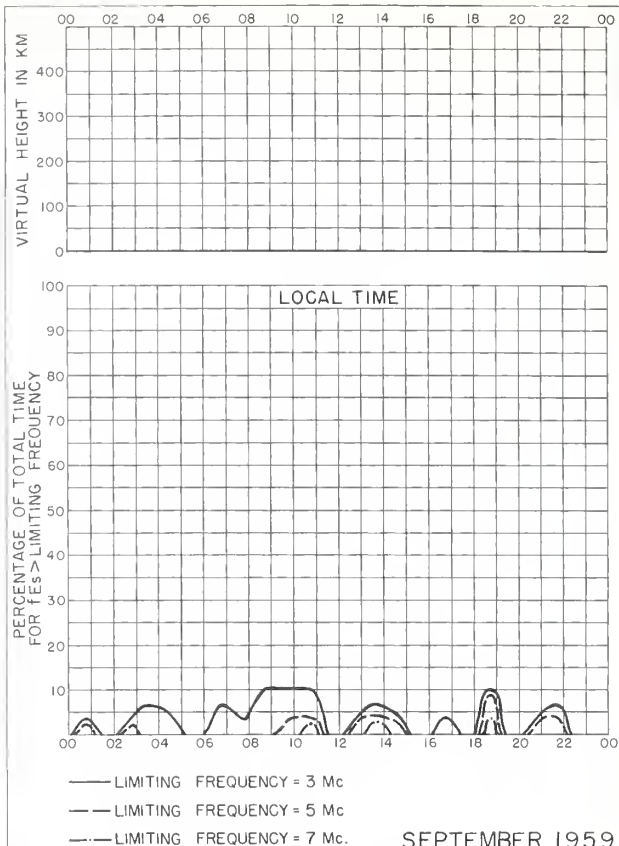
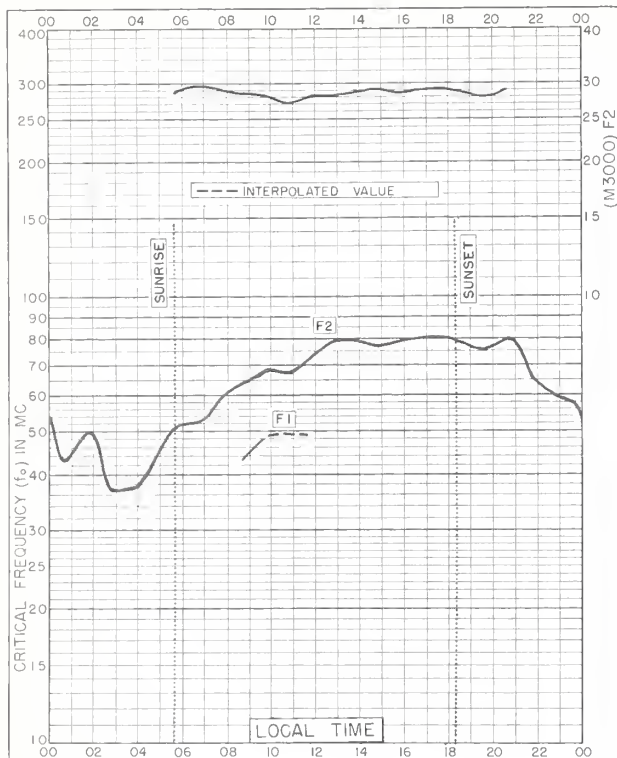


Fig. 44. EL CERILLO, MEXICO

OCTOBER 1959



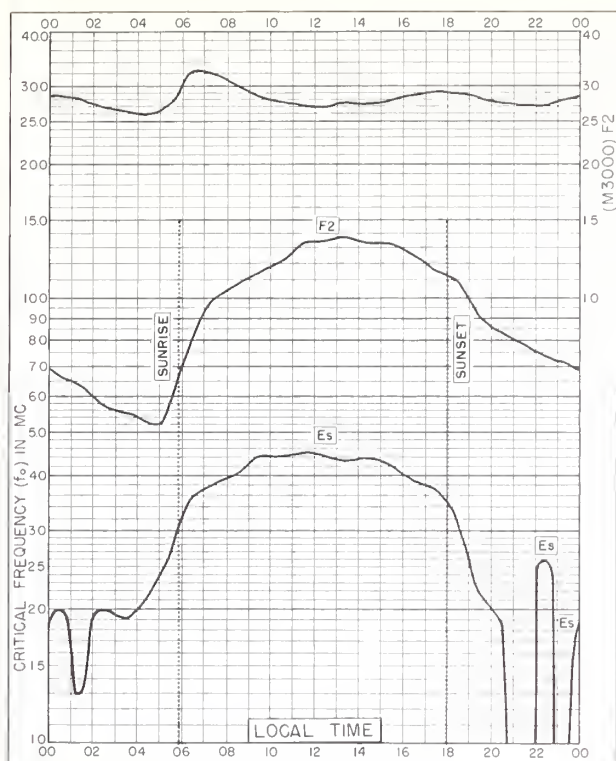


Fig. 49. EL CERILLO, MEXICO
19.3°N, 99.5°W SEPTEMBER 1959

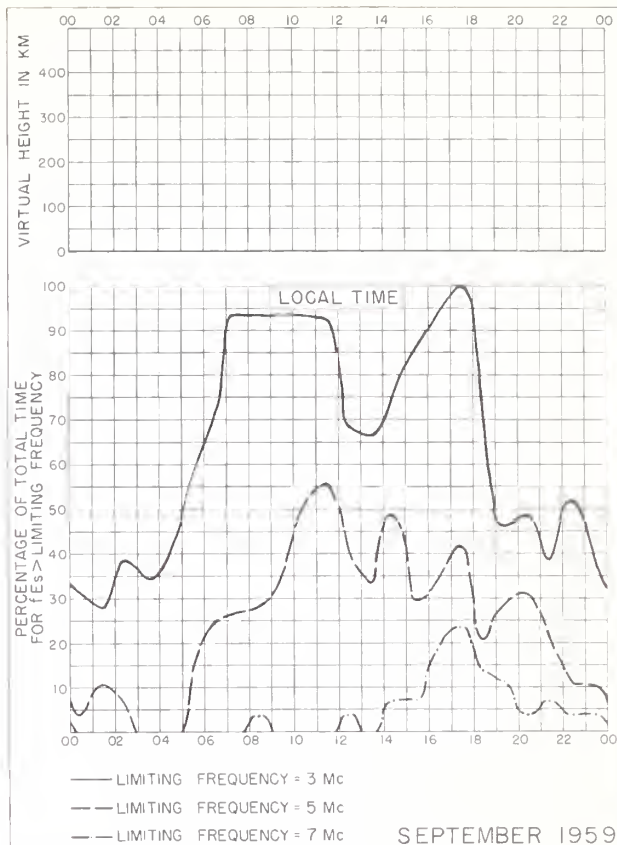


Fig. 50. EL CERILLO, MEXICO

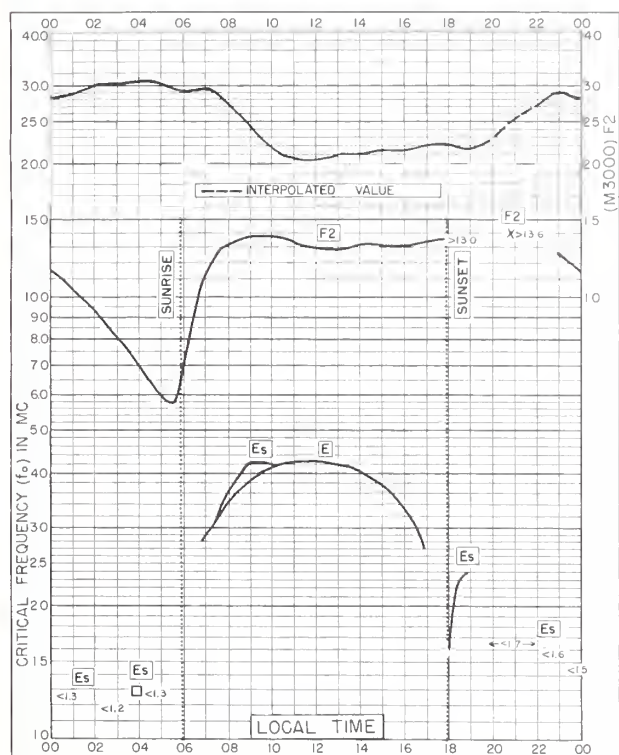


Fig. 51. SINGAPORE, BRITISH MALAYA
1.3°N, 103.8°E SEPTEMBER 1959

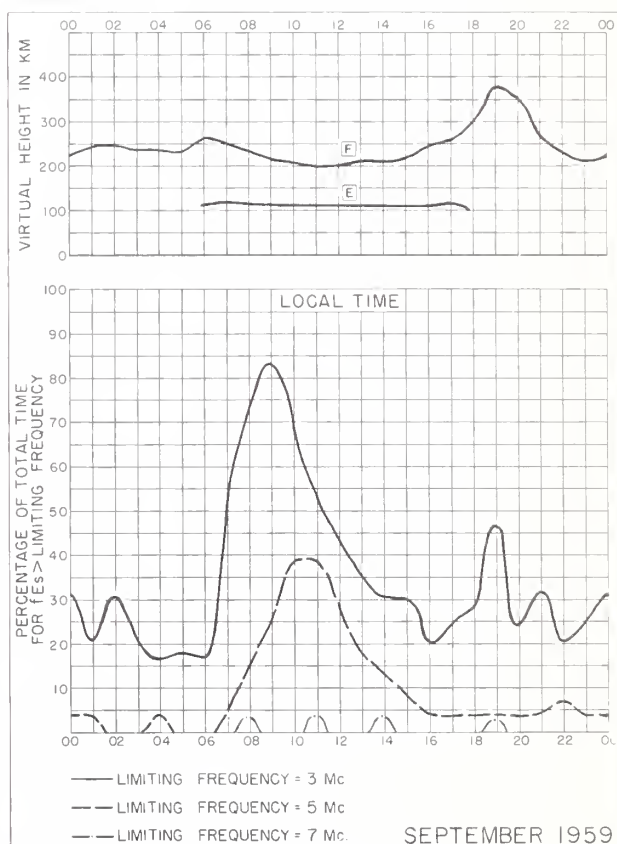


Fig. 52. SINGAPORE, BRITISH MALAYA



Fig. 53. LWIRO, BELGIAN CONGO
2.3°S, 28.8°E SEPTEMBER 1959

NBS 503

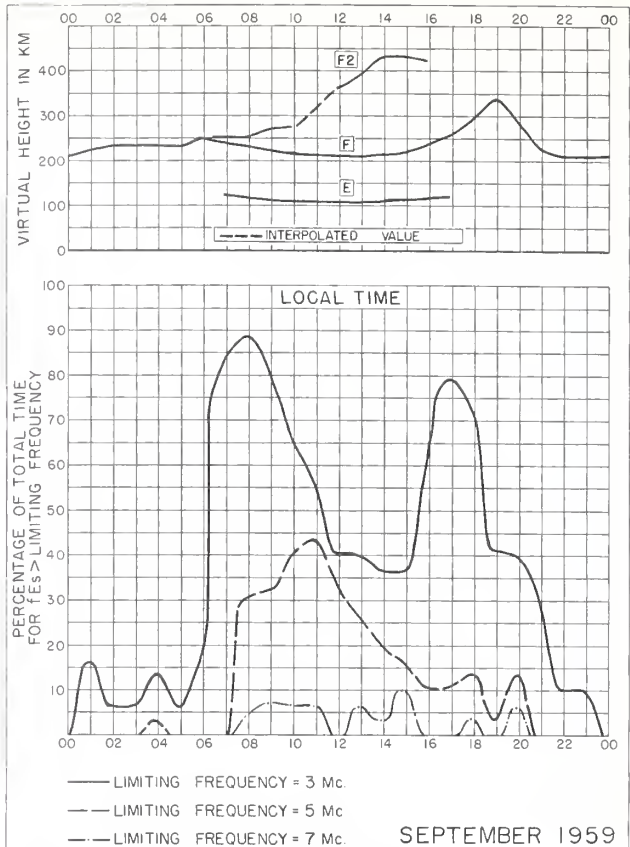


Fig. 54. LWIRO, BELGIAN CONGO

NBS 490

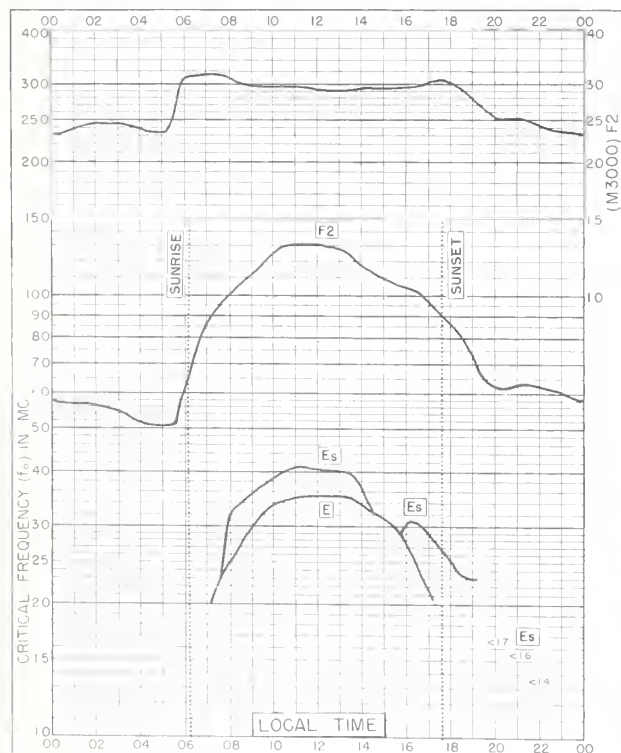


Fig. 55. FALKLAND IS.
51.7°S, 57.8°W SEPTEMBER 1959

NBS 503

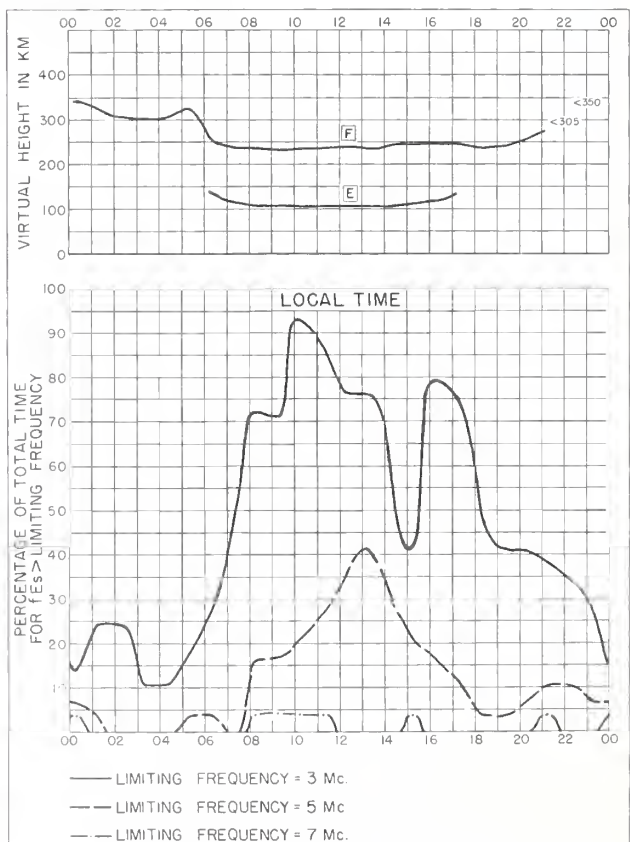


Fig. 56. FALKLAND IS. SEPTEMBER 1959

NBS 490

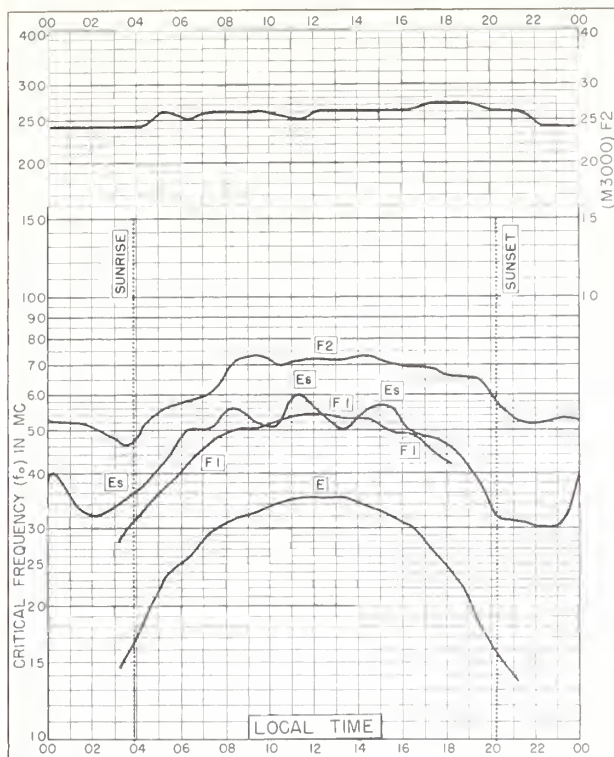


Fig. 57. LYCKSELE, SWEDEN
64.6°N, 18.8°E

AUGUST 1959

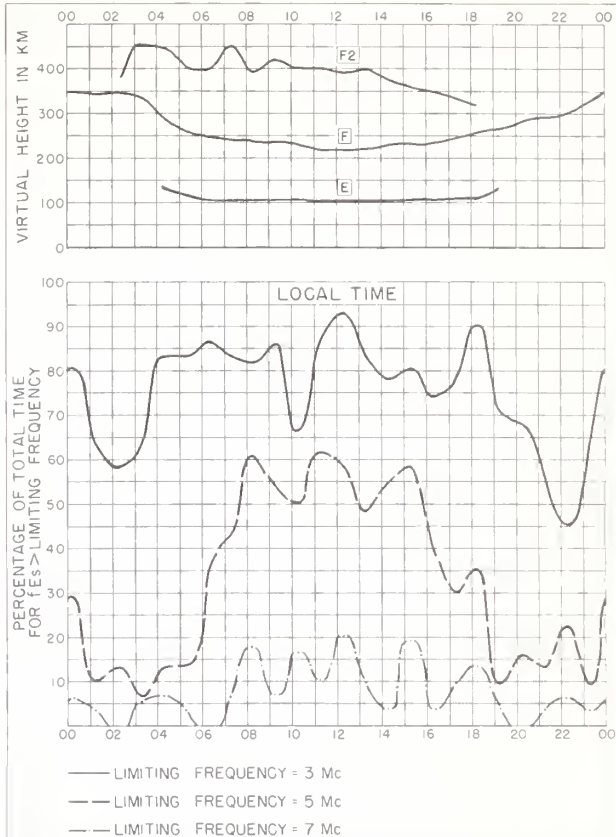


Fig. 58. LYCKSELE, SWEDEN

AUGUST 1959

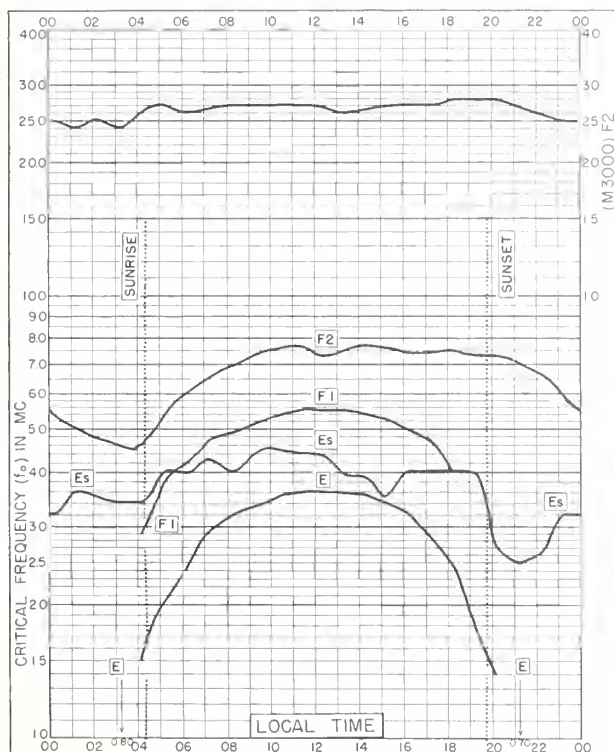


Fig. 59. UPSALA, SWEDEN
59.8°N, 17.6°E

AUGUST 1959

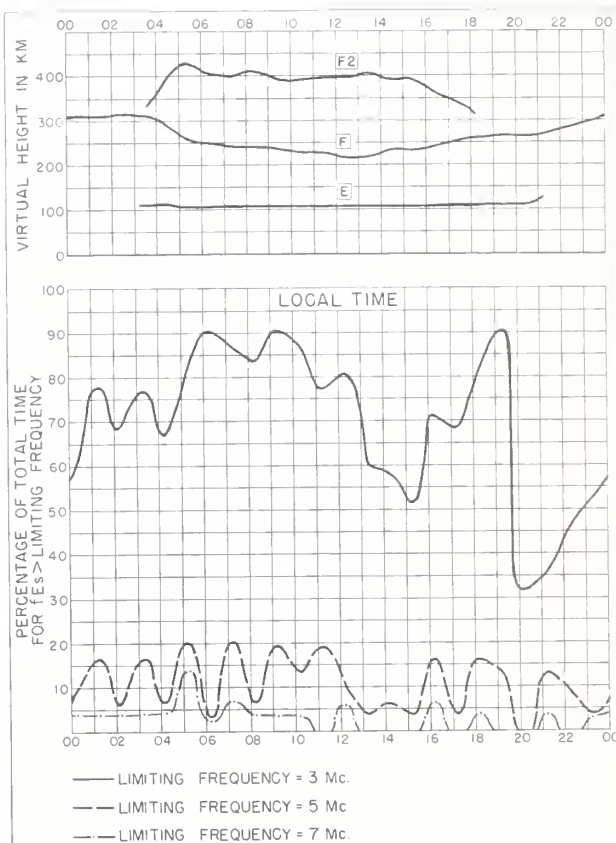


Fig. 60. UPSALA, SWEDEN

AUGUST 1959

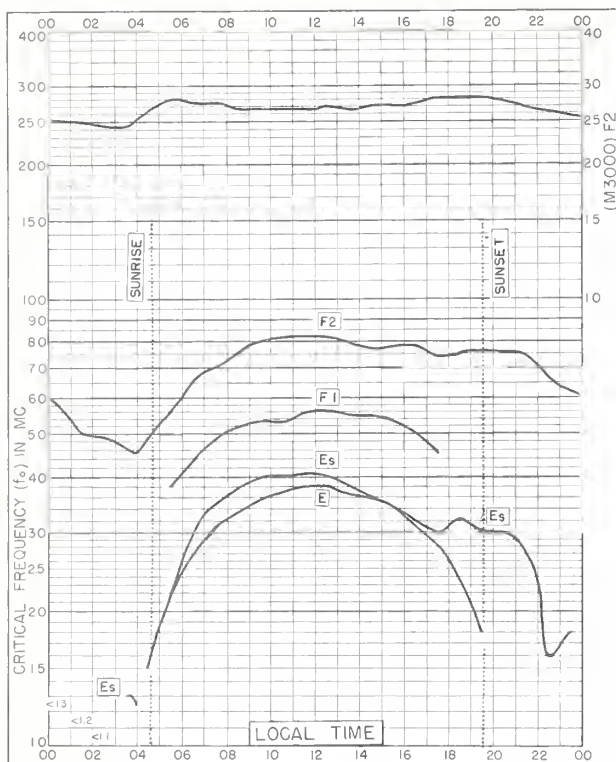


Fig. 61. MOSCOW, U. S. S. R.
55.5°N, 37.3°E

AUGUST 1959

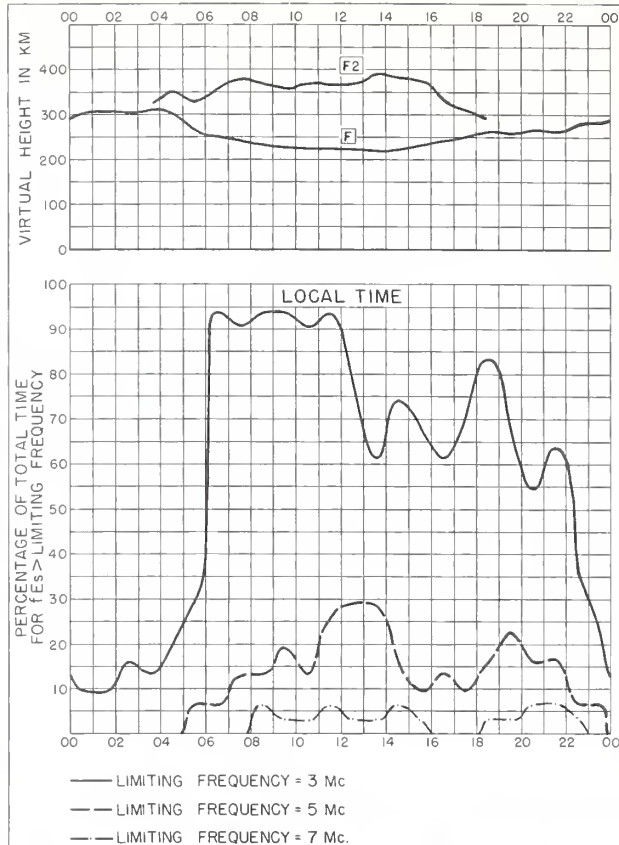


Fig. 62. MOSCOW, U. S. S. R.

AUGUST 1959

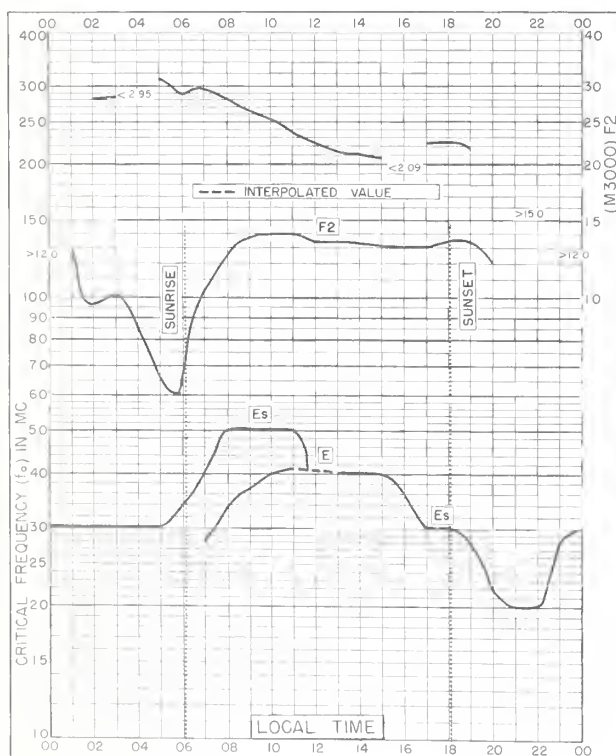


Fig. 63. BUNIA, BELGIAN CONGO
1.5°N, 30.2°E

AUGUST 1959

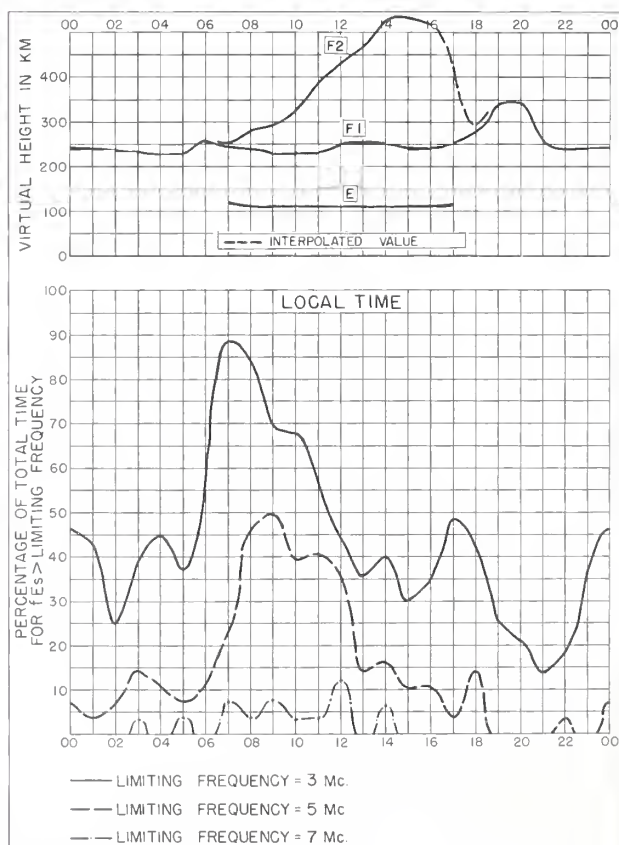


Fig. 64. BUNIA, BELGIAN CONGO

AUGUST 1959

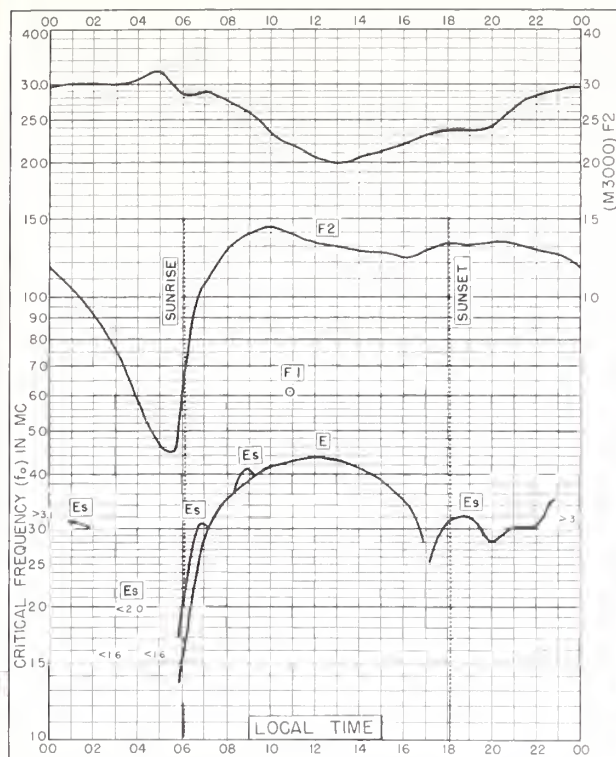


Fig. 65. SINGAPORE, BRITISH MALAYA
1.3°N, 103.8°E
AUGUST 1959

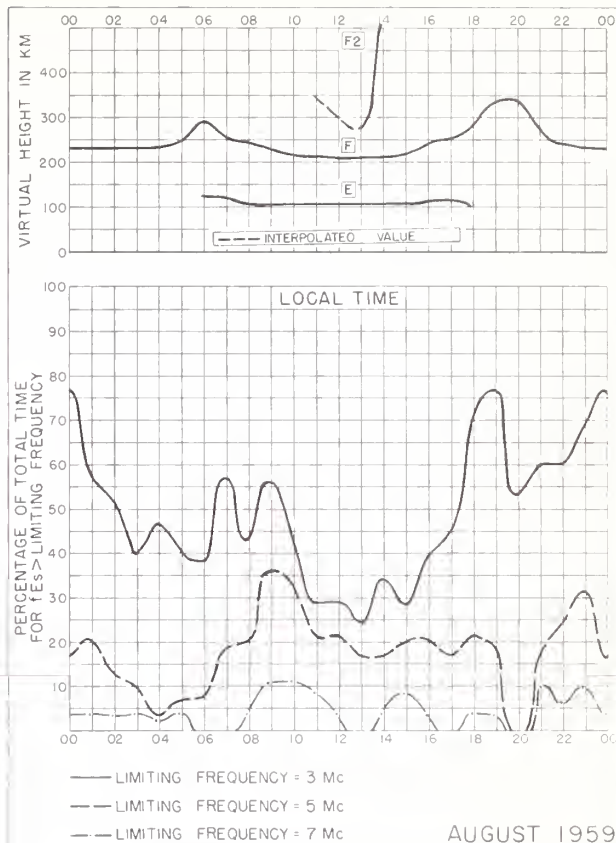


Fig. 66. SINGAPORE, BRITISH MALAYA

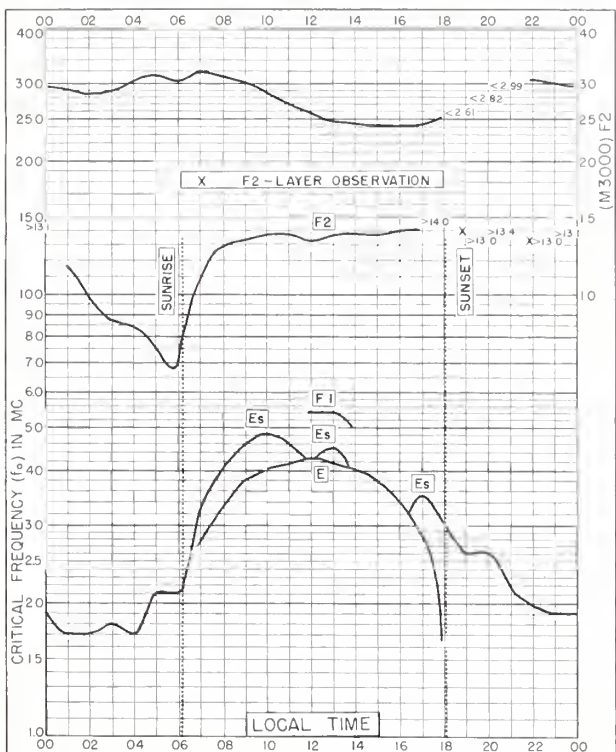


Fig. 67. LWIRO, BELGIAN CONGO
2.3°S, 28.8°E
AUGUST 1959

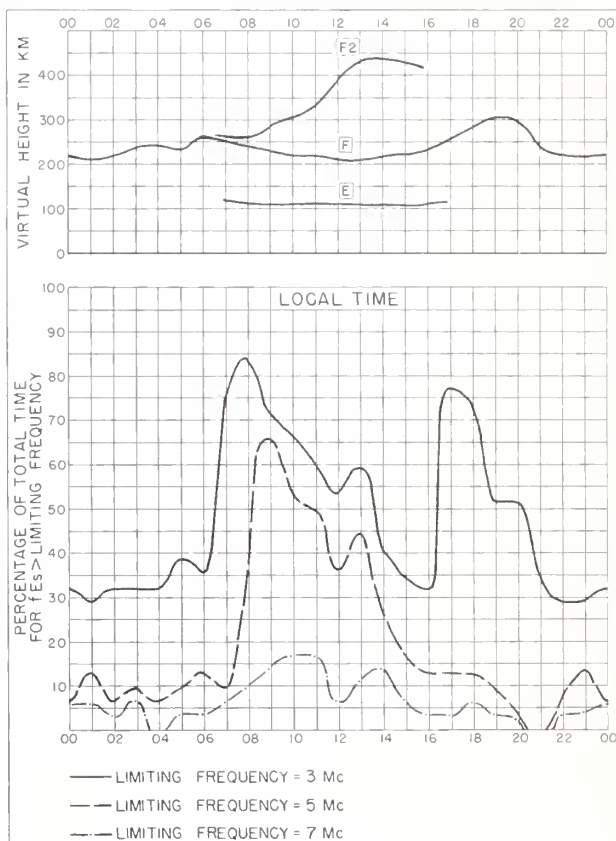


Fig. 68. LWIRO, BELGIAN CONGO
AUGUST 1959

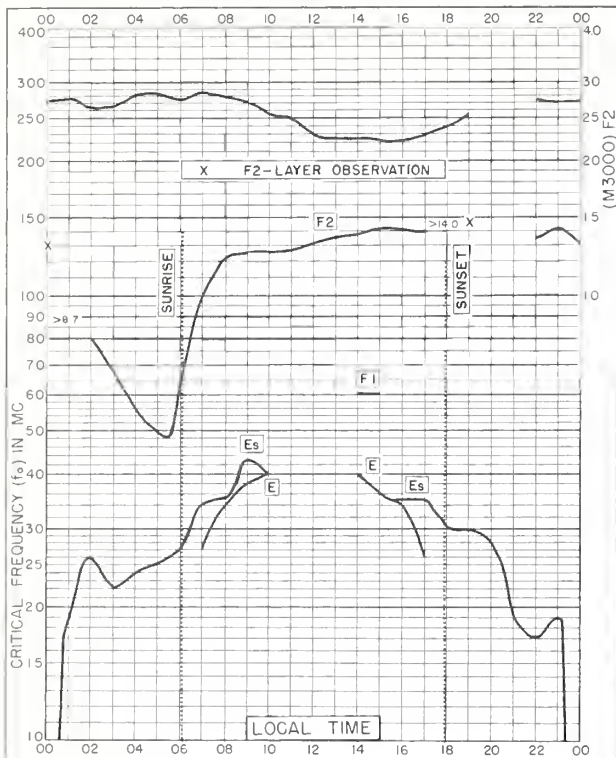


Fig. 69. LEOPOLDVILLE, BELGIAN CONGO
4.4°S, 15.2°E
AUGUST 1959

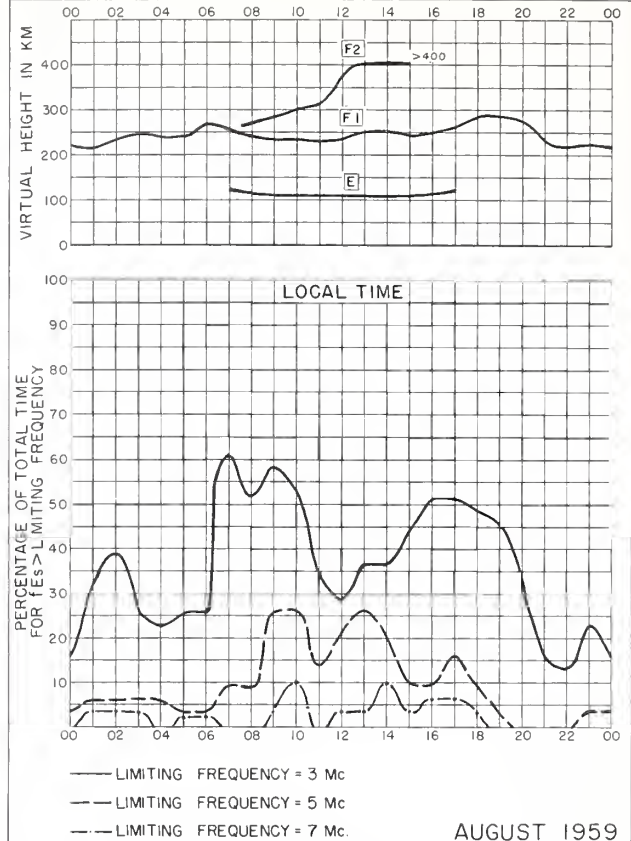


Fig. 70. LEOPOLDVILLE, BELGIAN CONGO
AUGUST 1959

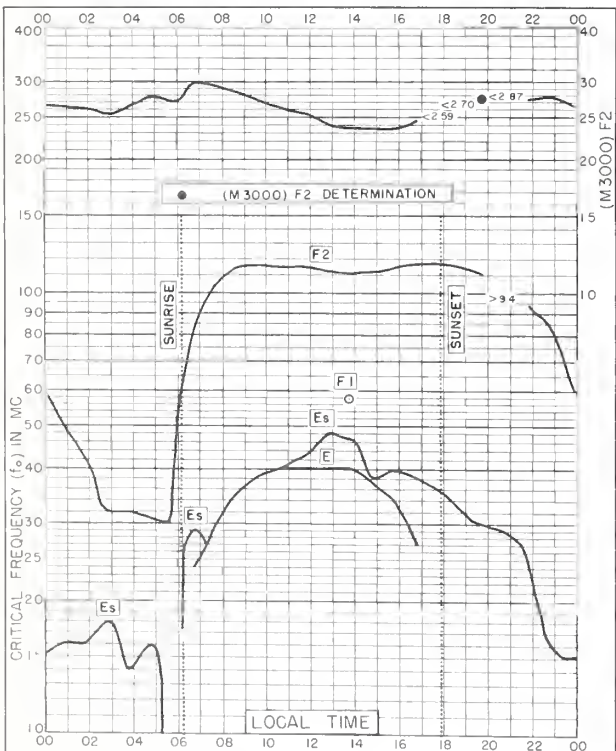


Fig. 71. ELISABETHVILLE, BELGIAN CONGO
11.6°S, 27.5°E
AUGUST 1959

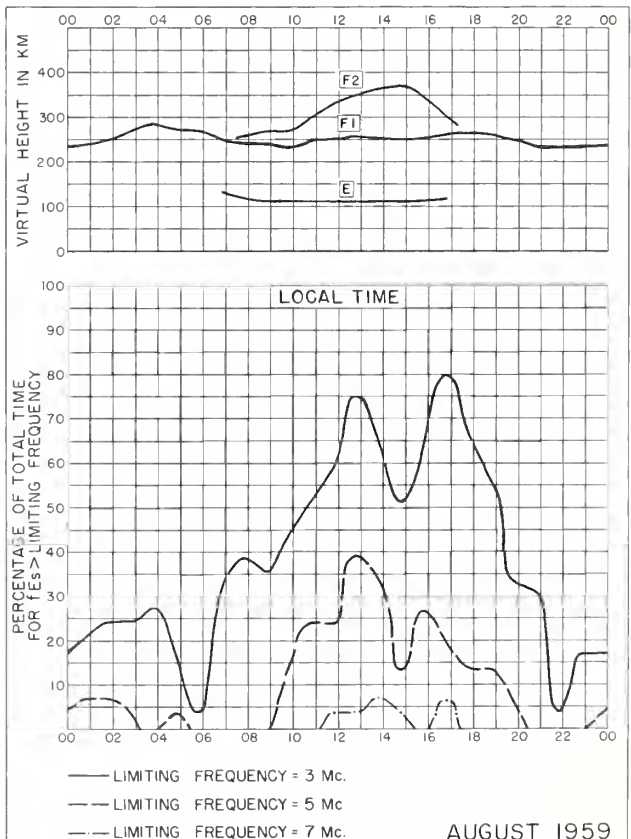


Fig. 72. ELISABETHVILLE, BELGIAN CONGO
AUGUST 1959

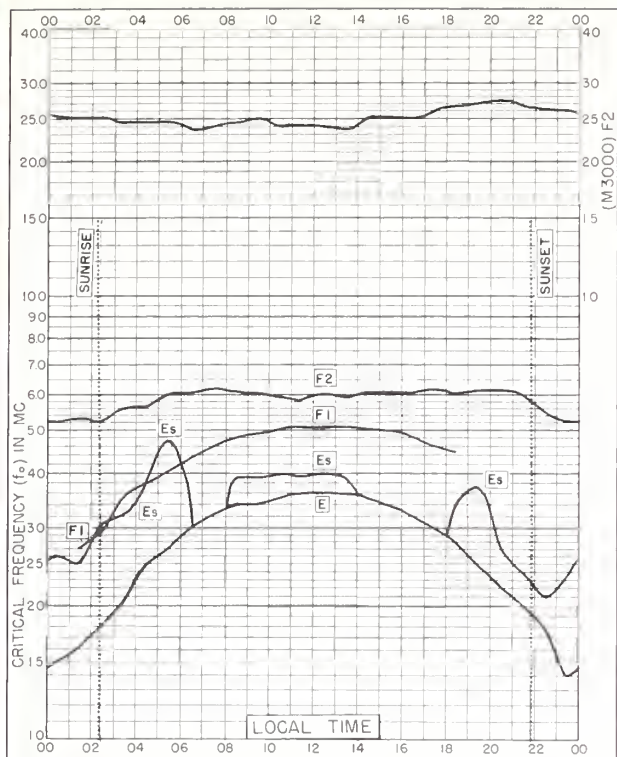


Fig. 73. PROVIDENIE BAY, U.S.S.R.
64.4°N, 186.6°E

JULY 1959

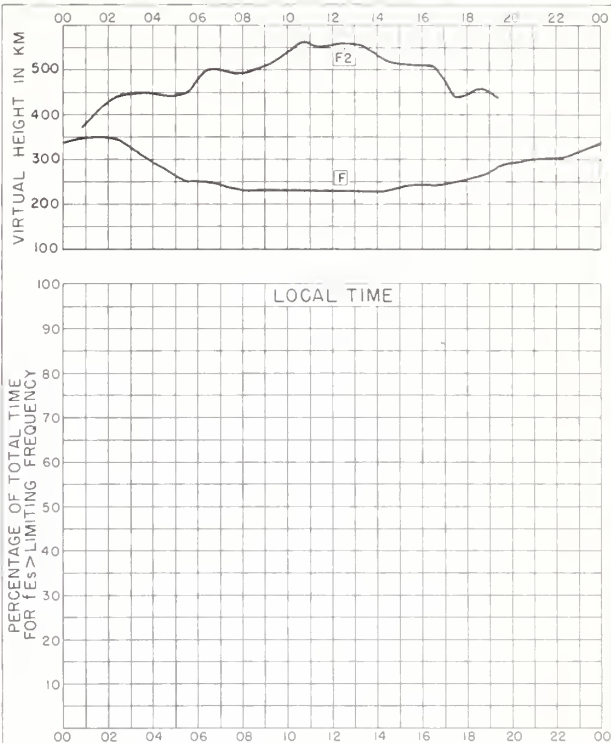


Fig. 74. PROVIDENIE BAY, U.S.S.R. JULY 1959

— LIMITING FREQUENCY = 3 Mc
— LIMITING FREQUENCY = 5 Mc
— LIMITING FREQUENCY = 7 Mc

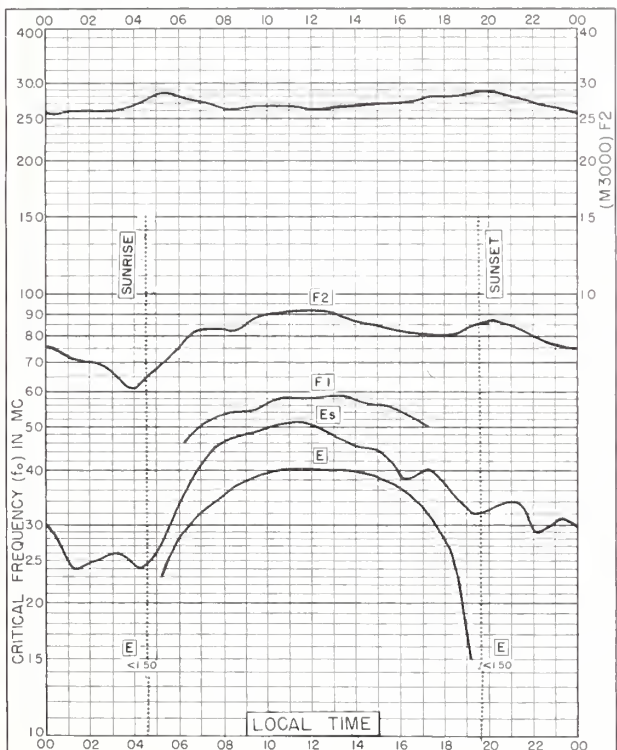


Fig. 75. SIMFEROPOL, U.S.S.R.
44.8°N, 34.1°E

JULY 1959

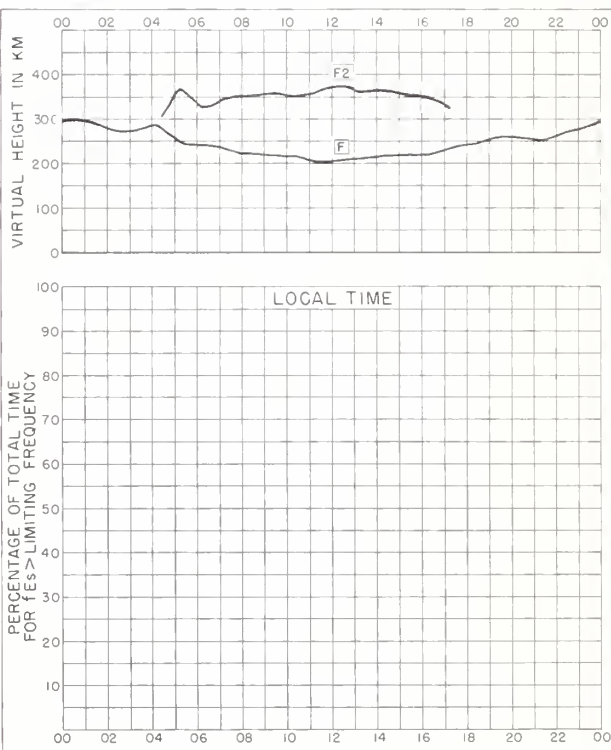


Fig. 76. SIMFEROPOL, U.S.S.R. JULY 1959

— LIMITING FREQUENCY = 3 Mc
— LIMITING FREQUENCY = 5 Mc
— LIMITING FREQUENCY = 7 Mc

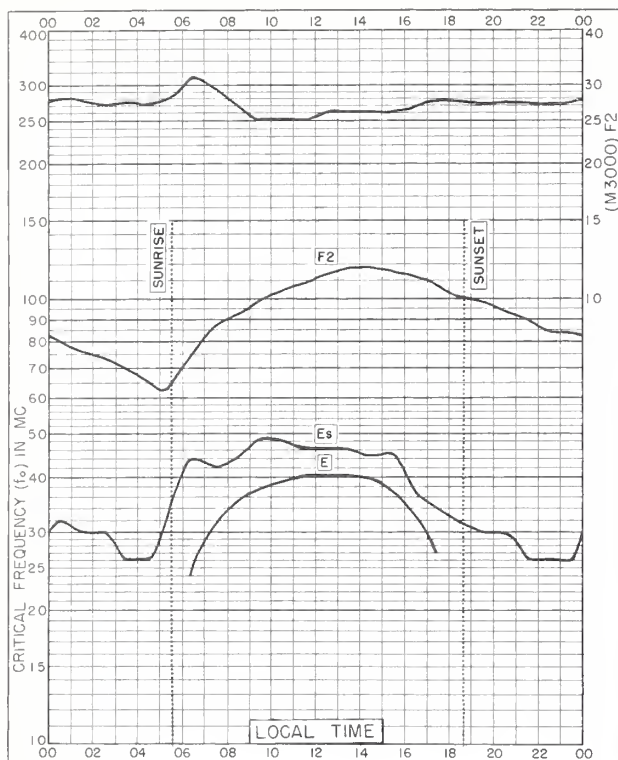


Fig. 77. EL CERILLO, MEXICO
19.3°N, 99.5°W

JULY 1959

NBS 503

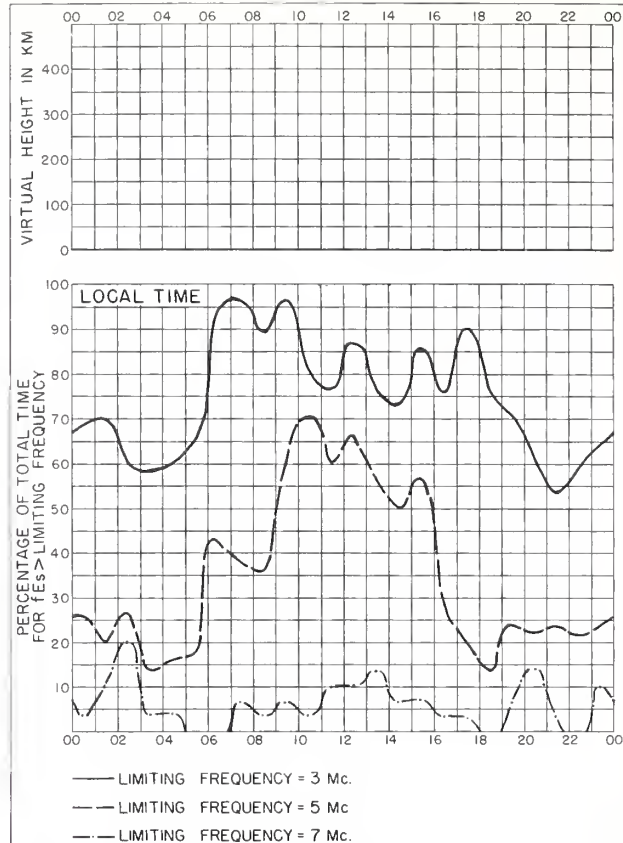


Fig. 78. EL CERILLO, MEXICO

JULY 1959

NBS 490

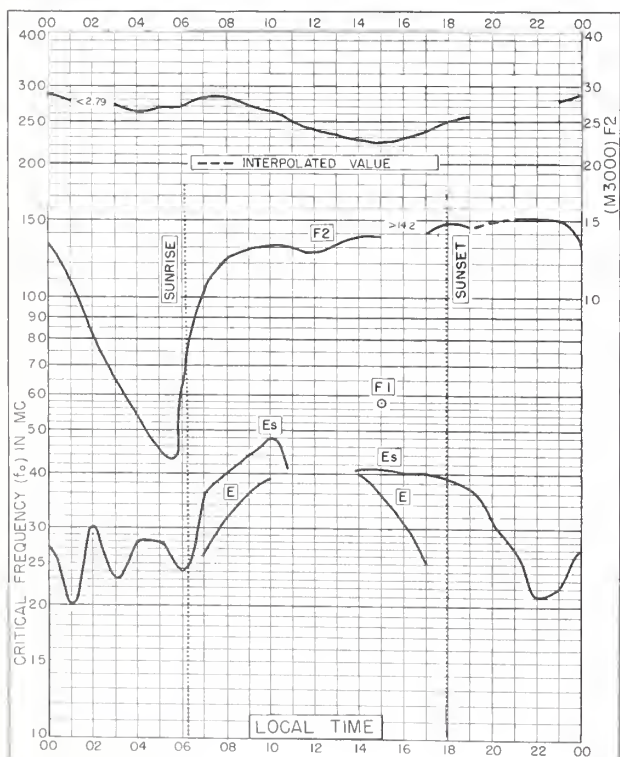


Fig. 79. LEOPOLDVILLE, BELGIAN CONGO
4.4°S, 15.2°E

JULY 1959

NBS 503

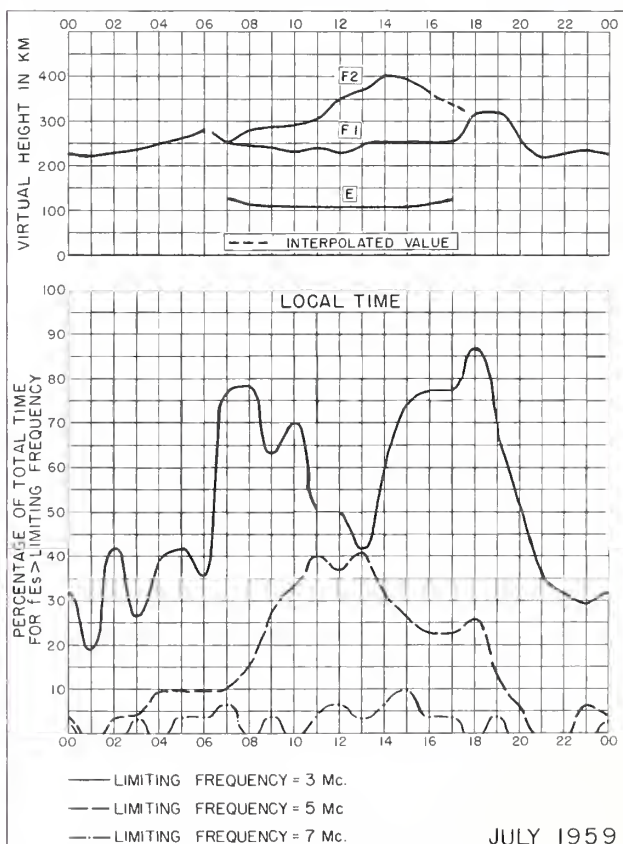


Fig. 80. LEOPOLDVILLE, BELGIAN CONGO

JULY 1959

NBS 490

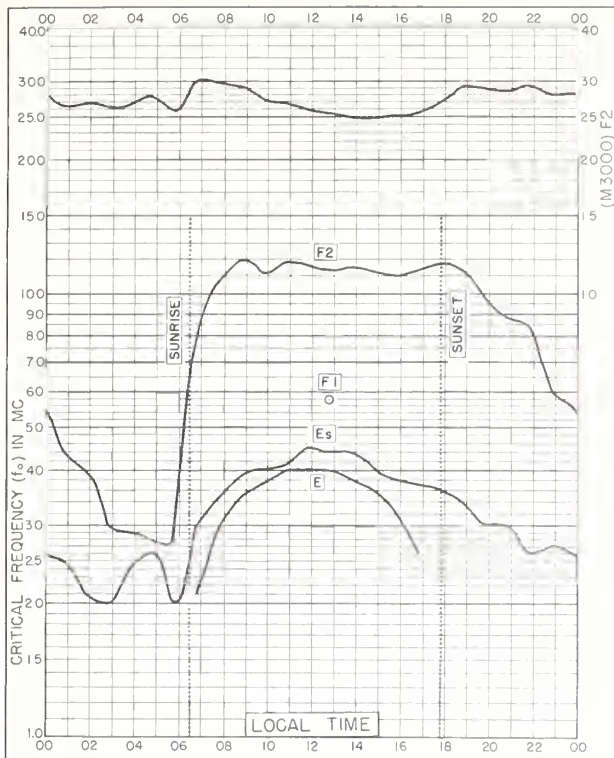


Fig. 81. ELISABETHVILLE, BELGIAN CONGO
11.6°S, 27.5°E
JULY 1959

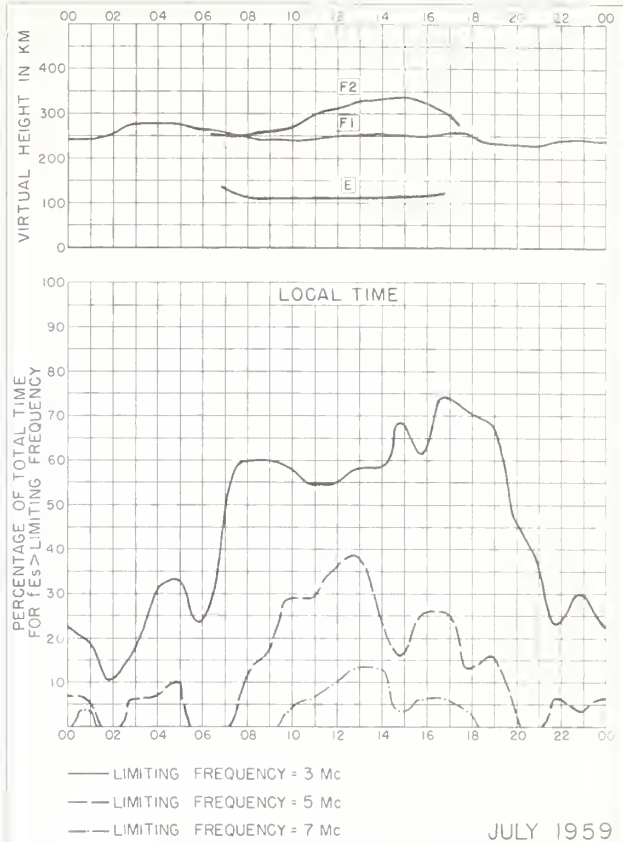


Fig. 82. ELISABETHVILLE, BELGIAN CONGO
JULY 1959

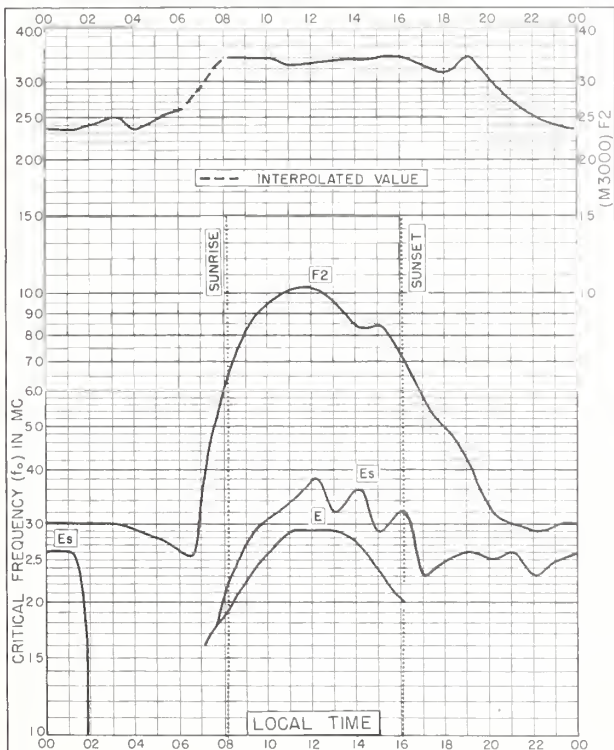


Fig. 83. FALKLAND IS.
51.7°S, 57.8°W
JULY 1959

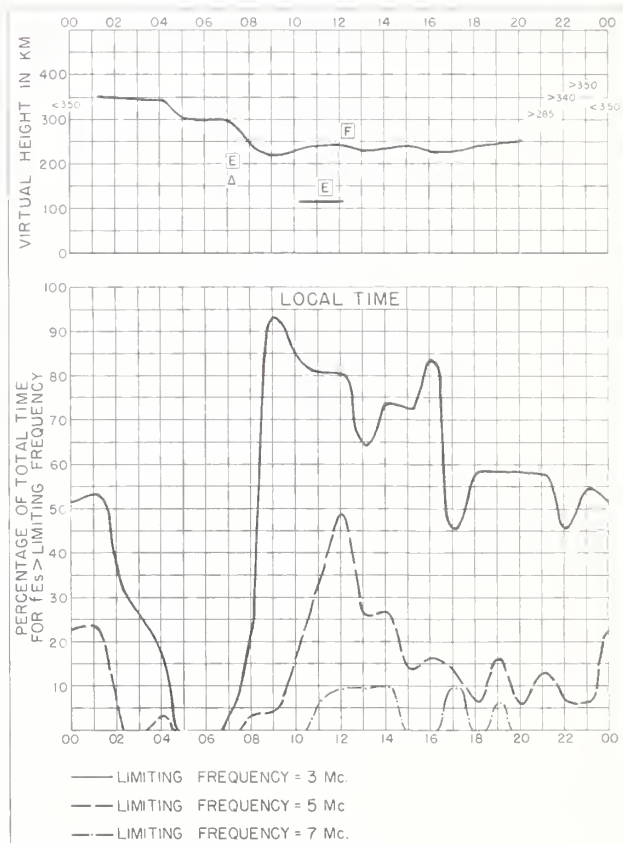
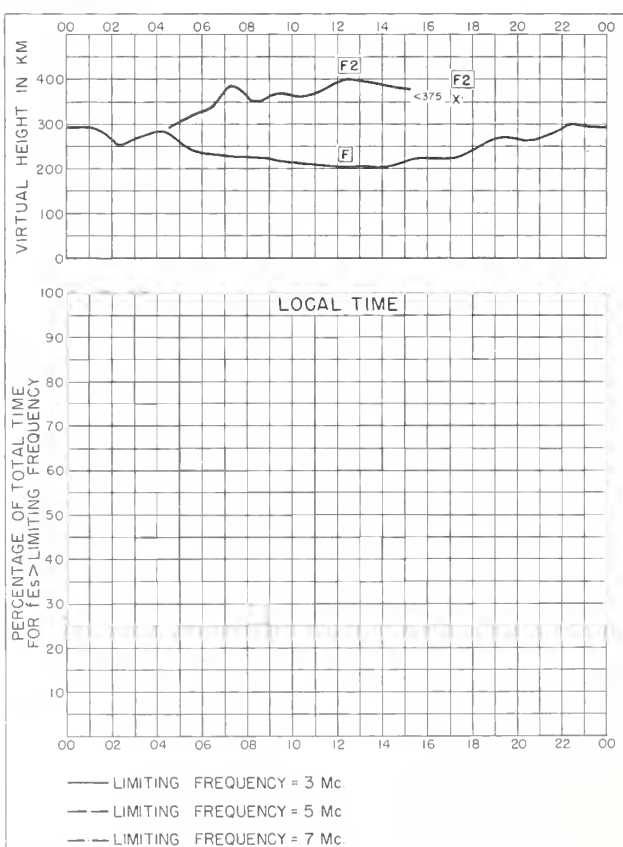
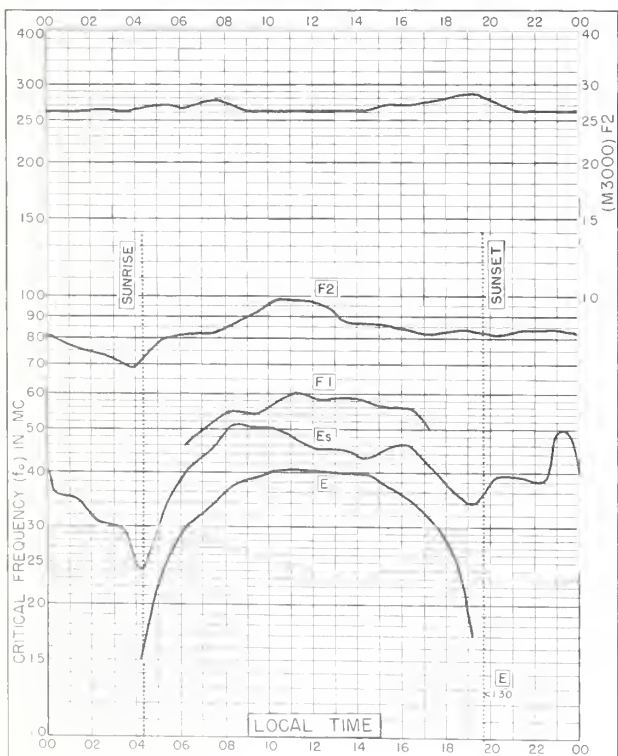
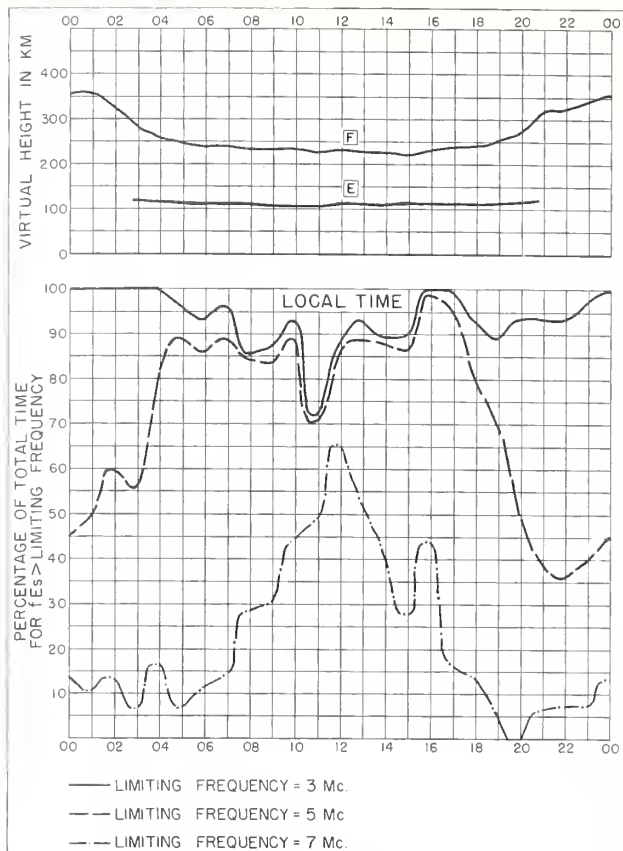
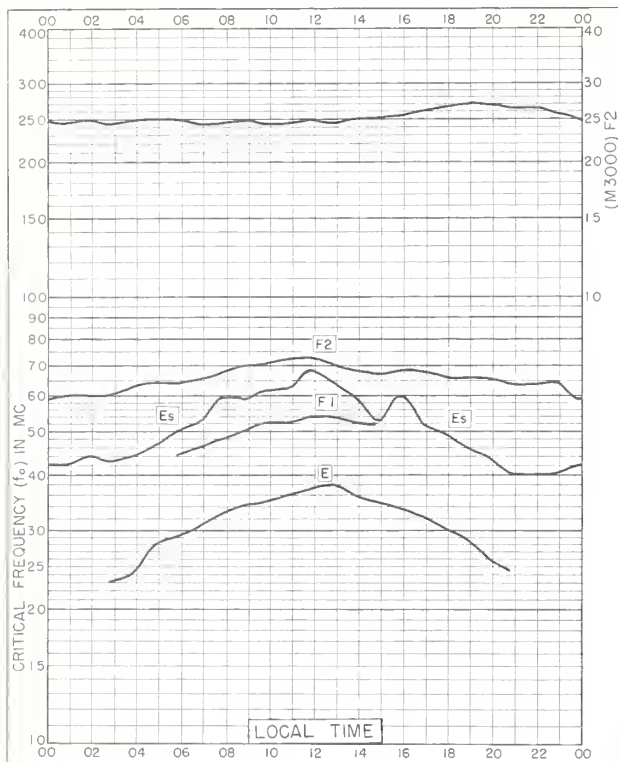


Fig. 84. FALKLAND IS.
JULY 1959



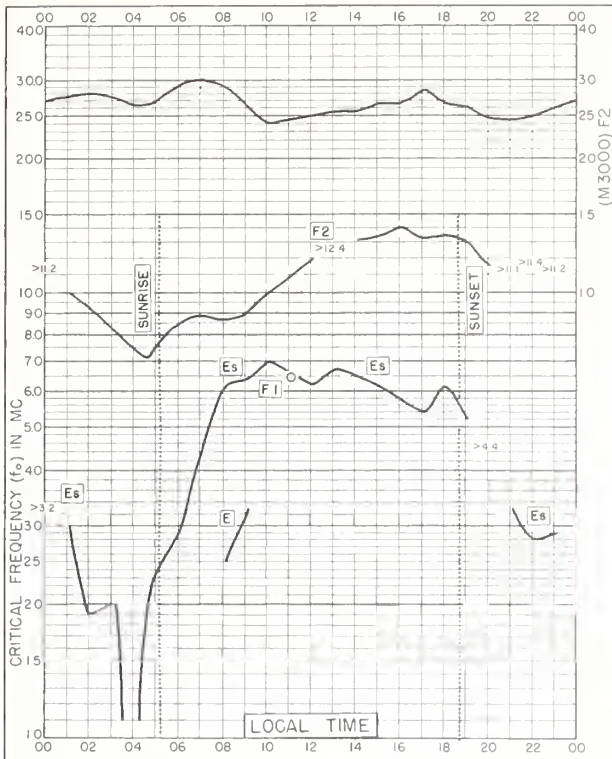


Fig. 89. FORMOSA, CHINA
25.0°N, 121.5°E

JUNE 1959

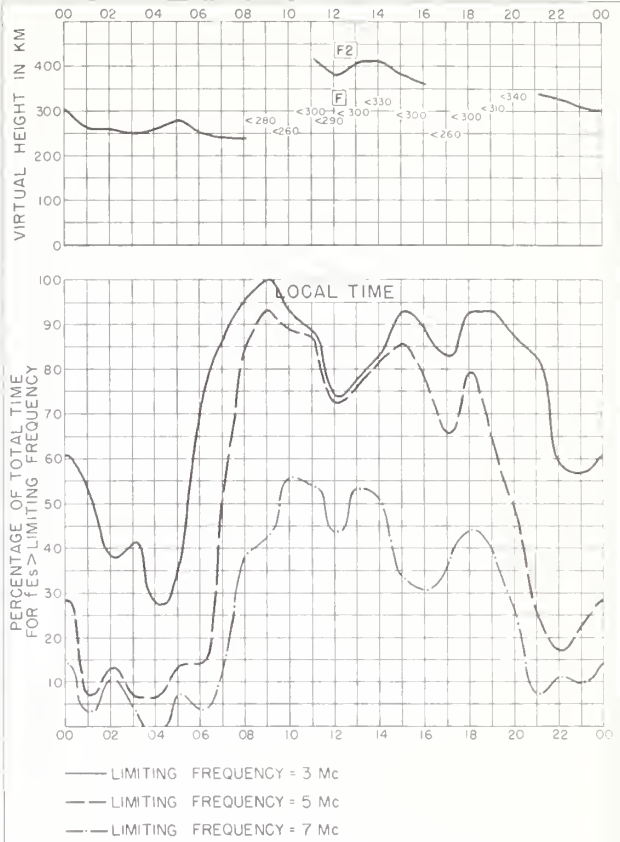


Fig. 90. FORMOSA, CHINA

JUNE 1959

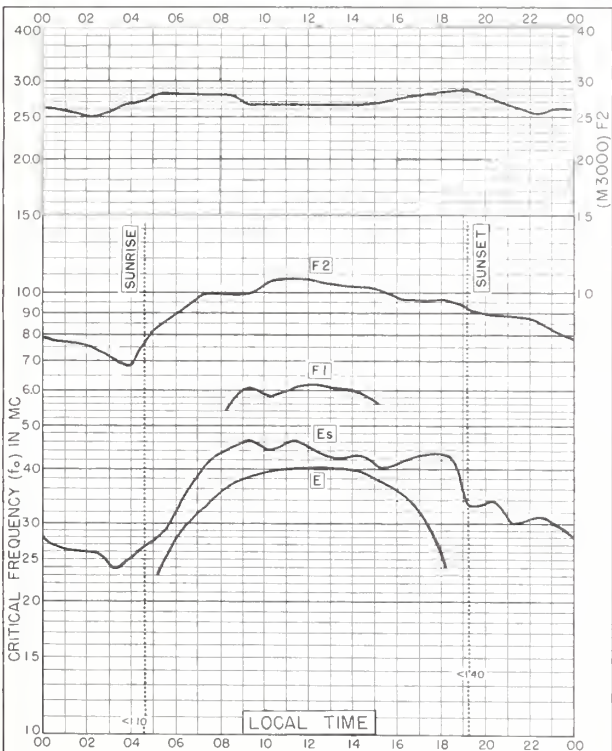


Fig. 91. SIMFEROPOL, U.S.S.R.
44.8°N, 34.1°E

MAY 1959

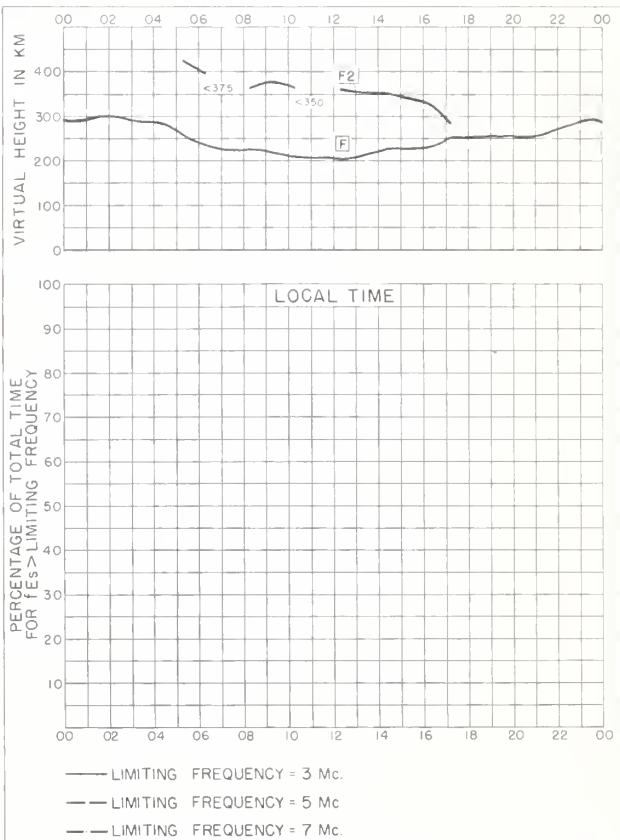


Fig. 92. SIMFEROPOL, U.S.S.R.

MAY 1959

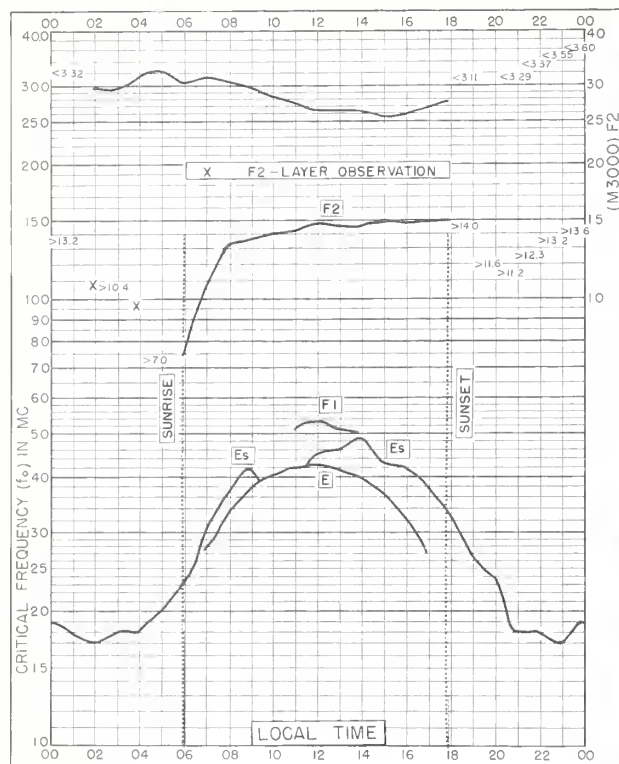


Fig. 93. LWIRO, BELGIAN CONGO
2.3°S, 28.8°E

MAY 1959

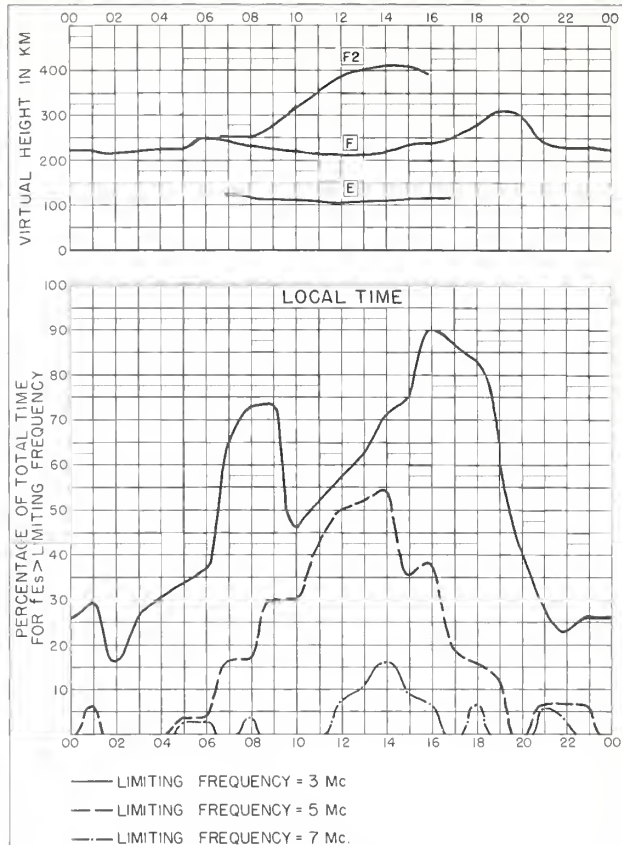


Fig. 94. LWIRO, BELGIAN CONGO

MAY 1959

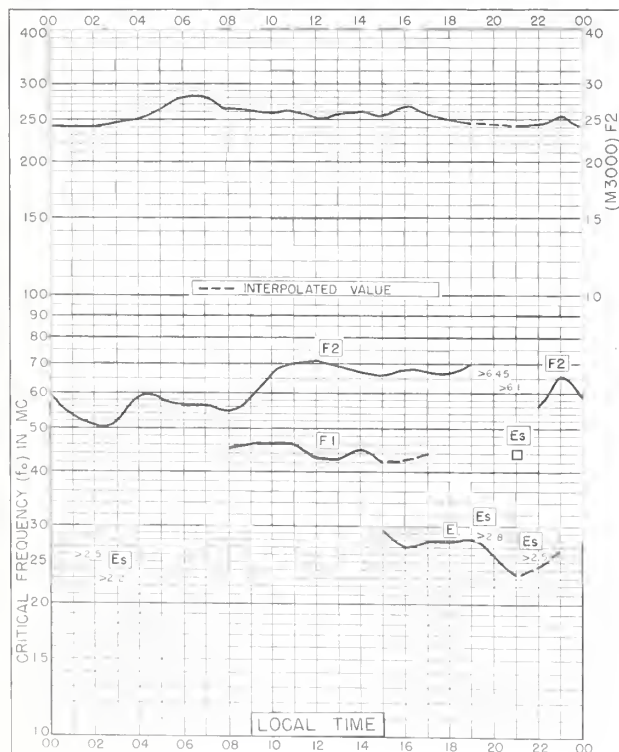


Fig. 95. BYRD STATION
80.0°S, 120.0°W

FEBRUARY 1959

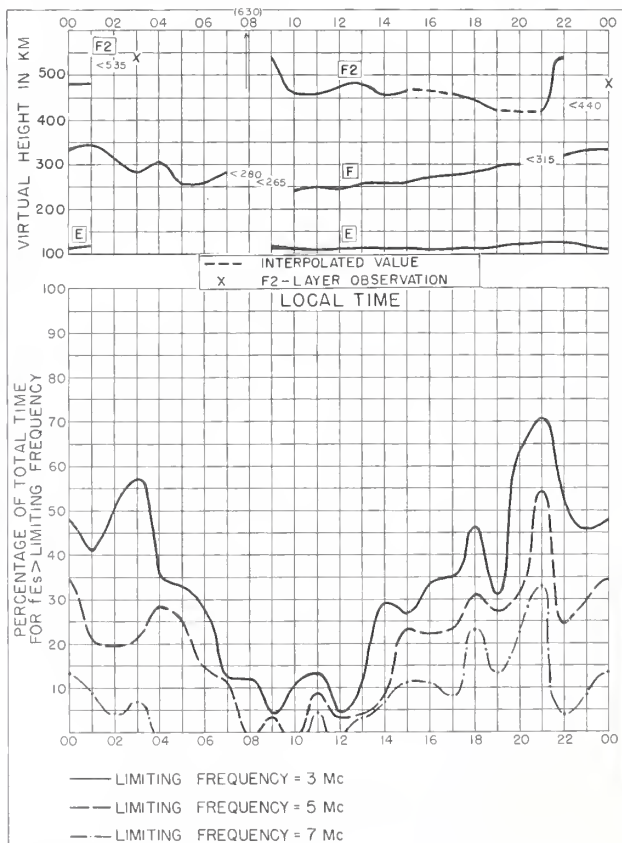


Fig. 96. BYRD STATION

FEBRUARY 1959

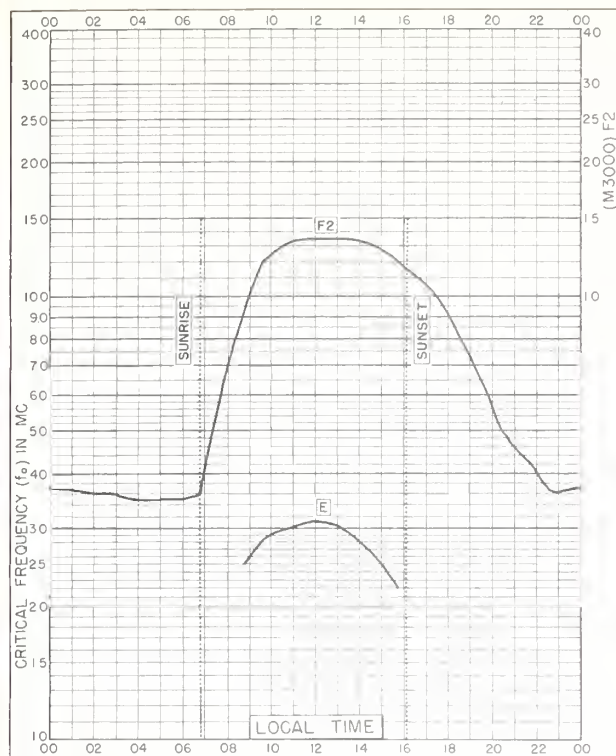


Fig. 97. VICTORIA, CANADA
48.4°N, 123.4°W DECEMBER 1958

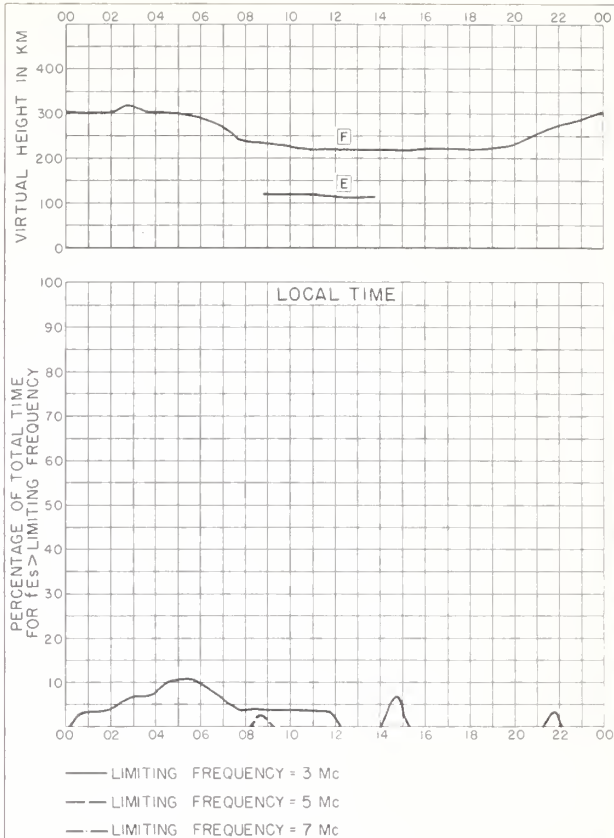


Fig. 98. VICTORIA, CANADA DECEMBER 1958

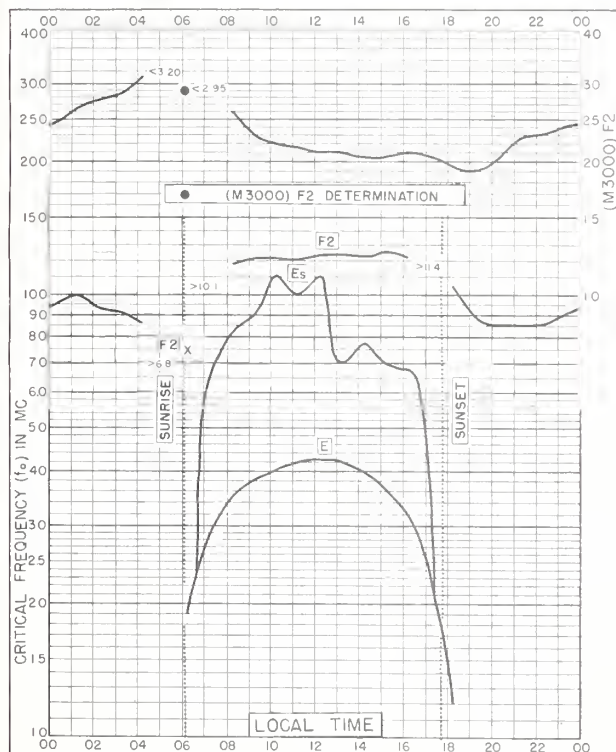


Fig. 99. IBADAN, NIGERIA
7.4°N, 3.9°E DECEMBER 1958

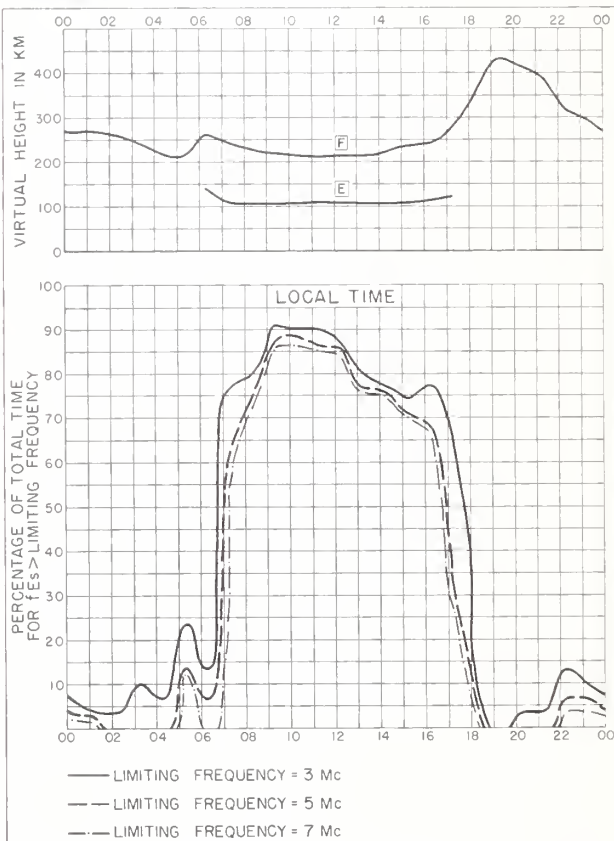


Fig. 100. IBADAN, NIGERIA DECEMBER 1958

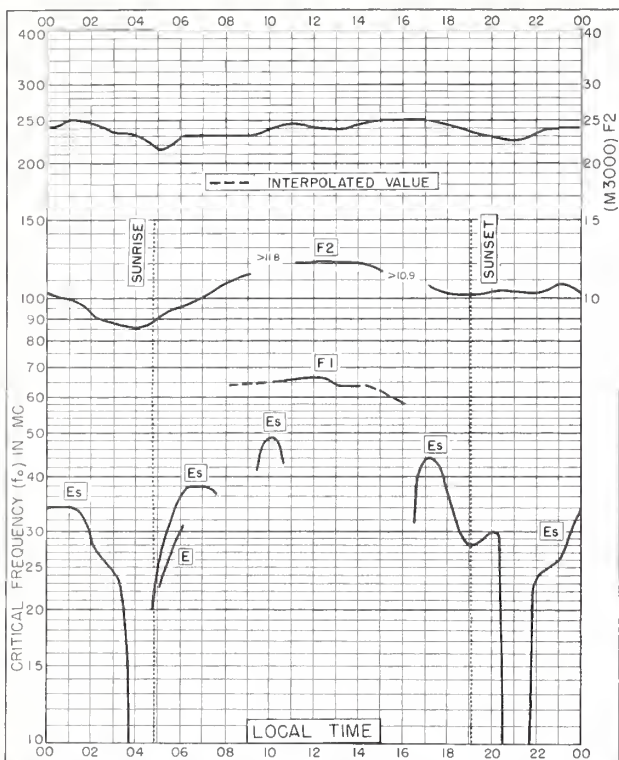


Fig. 101. BUENOS AIRES, ARGENTINA
34°S, 58°W
DECEMBER 1958

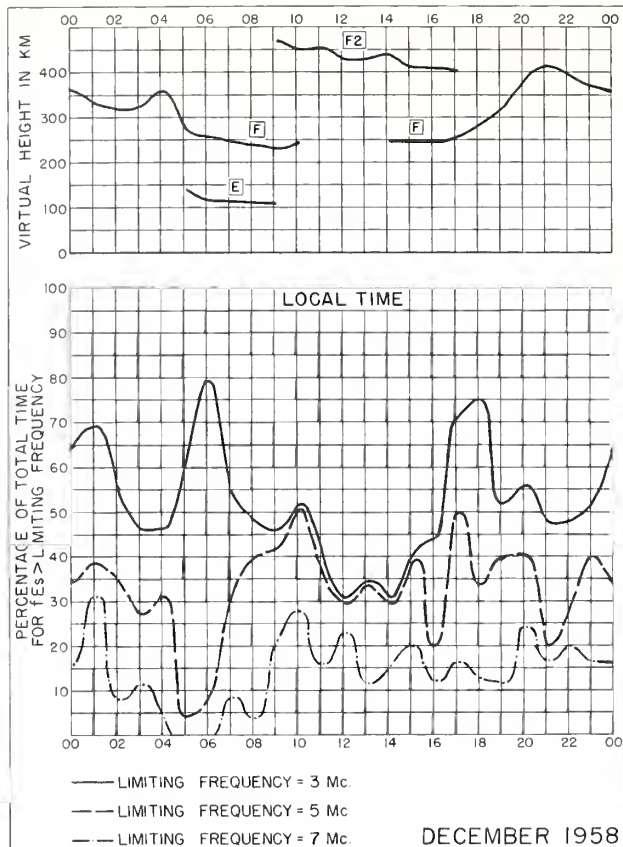


Fig. 102. BUENOS AIRES, ARGENTINA

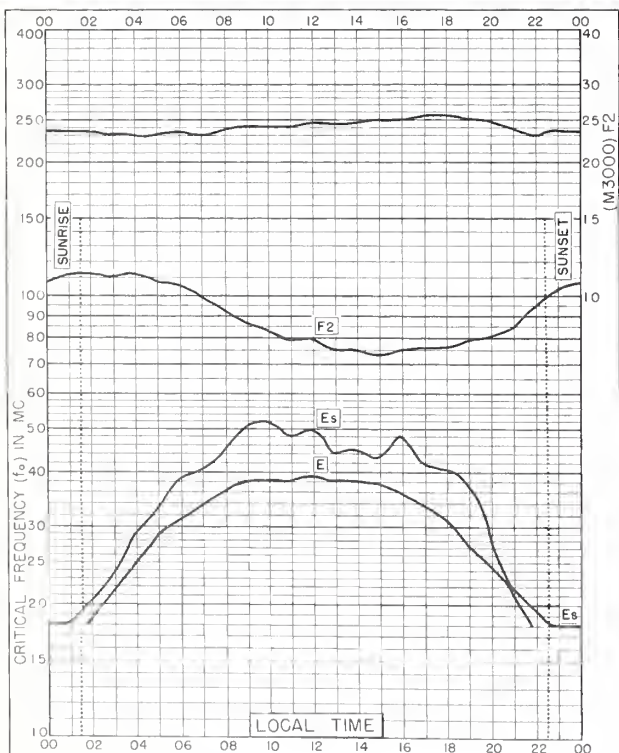


Fig. 103. PORT LOCKROY
64.8°S, 63.5°W
DECEMBER 1958

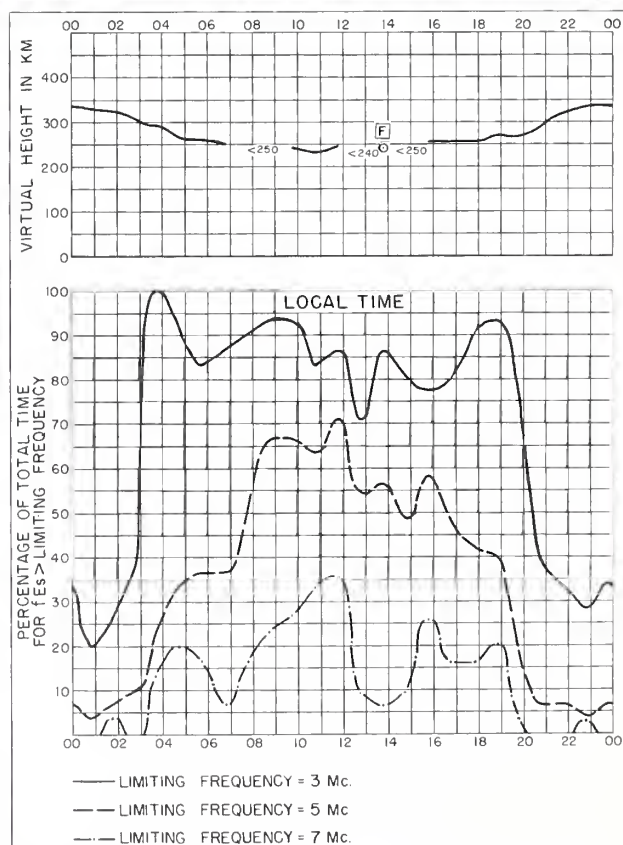
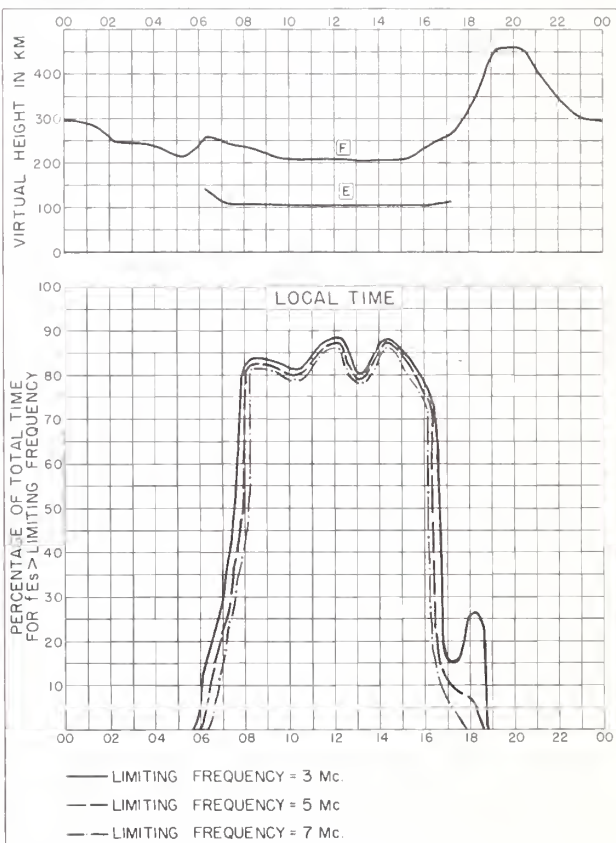
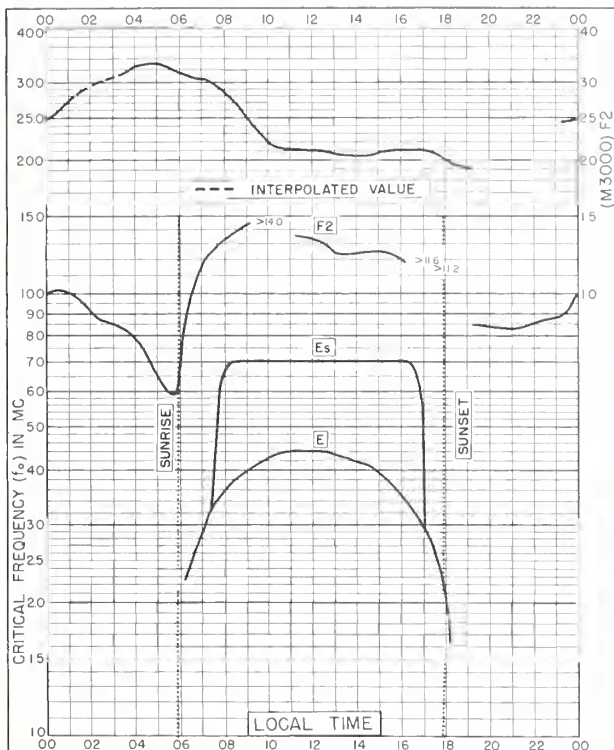
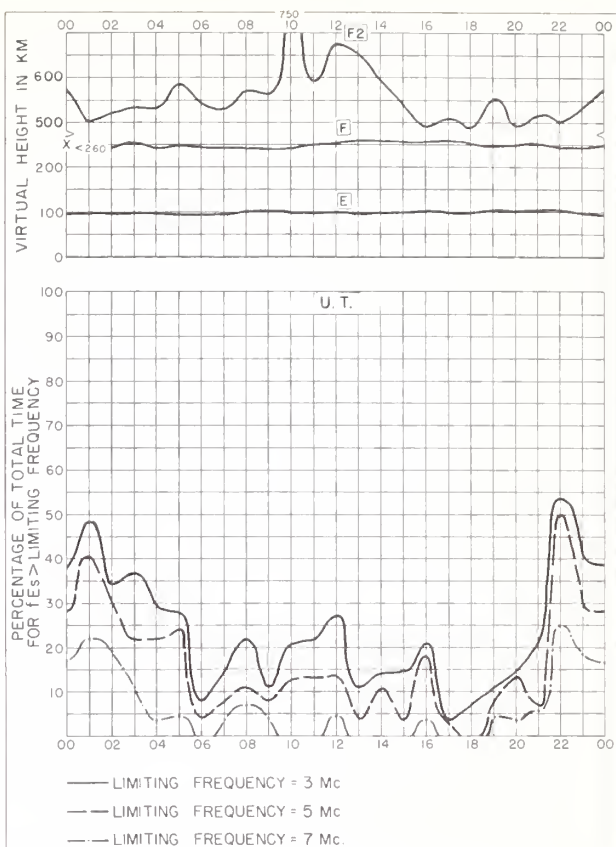
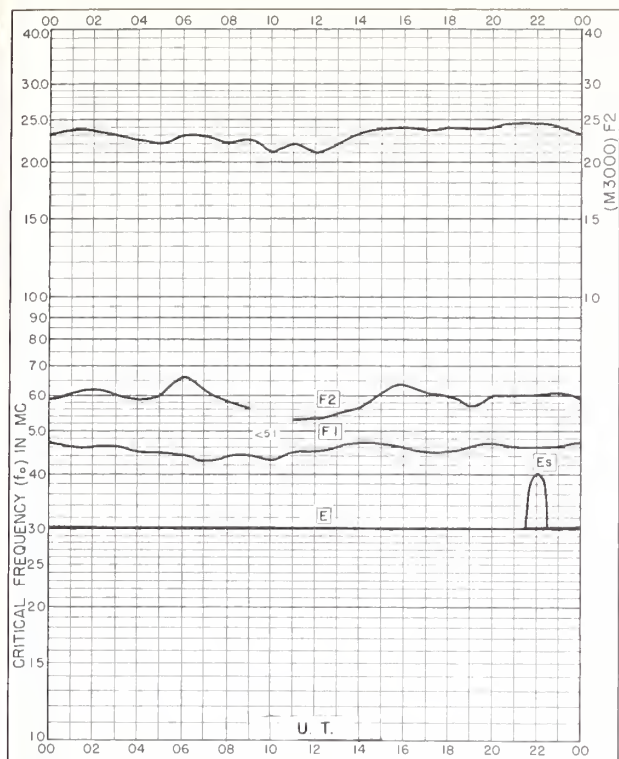


Fig. 104. PORT LOCKROY
DECEMBER 1958



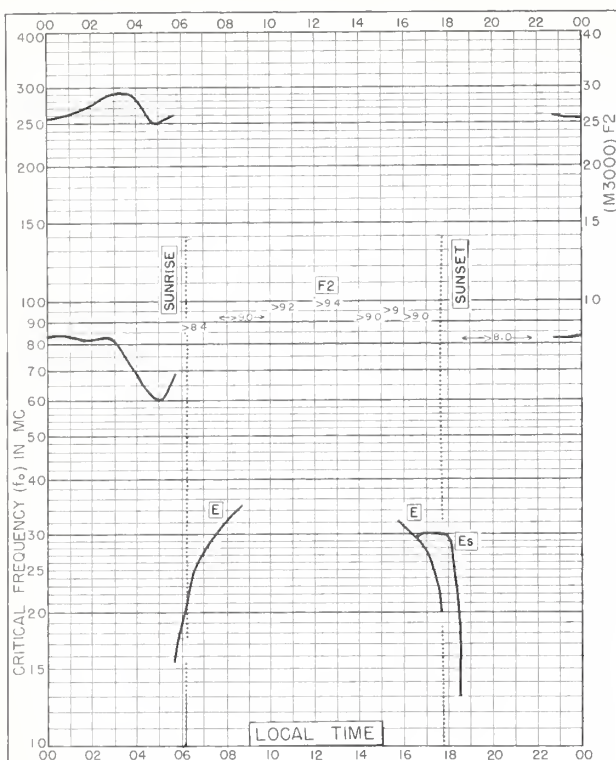


Fig. 109. TRELEW, ARGENTINA
43.0°S, 65.0°W SEPTEMBER 1958

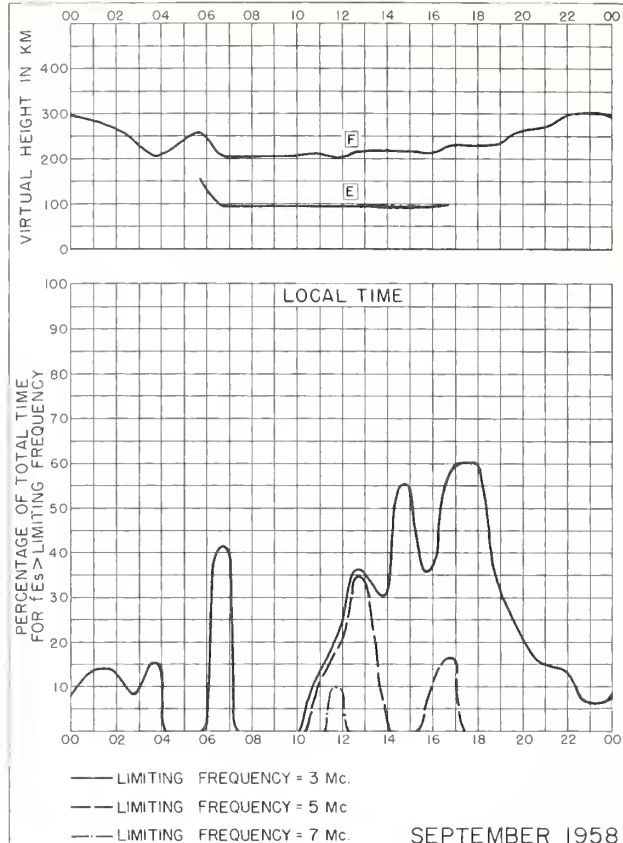


Fig. 110. TRELEW, ARGENTINA

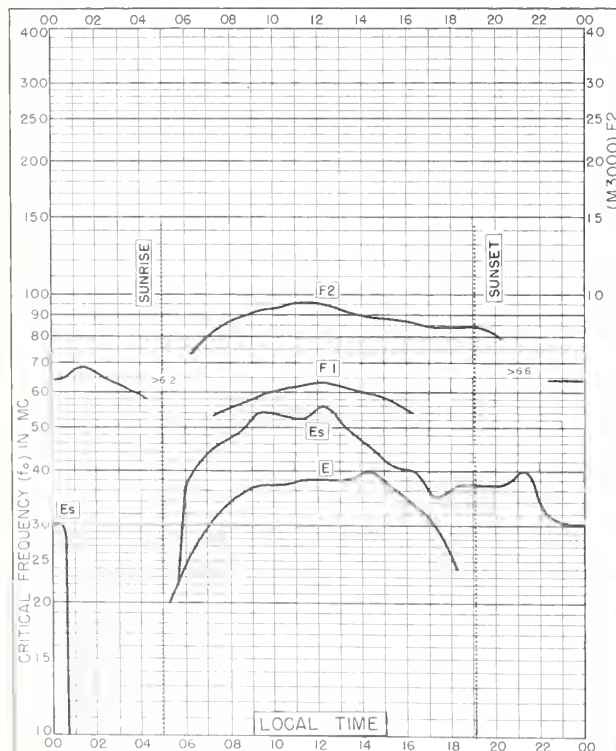


Fig. 111. BUDAPEST, HUNGARY
47.4°N, 19.2°E AUGUST 1958

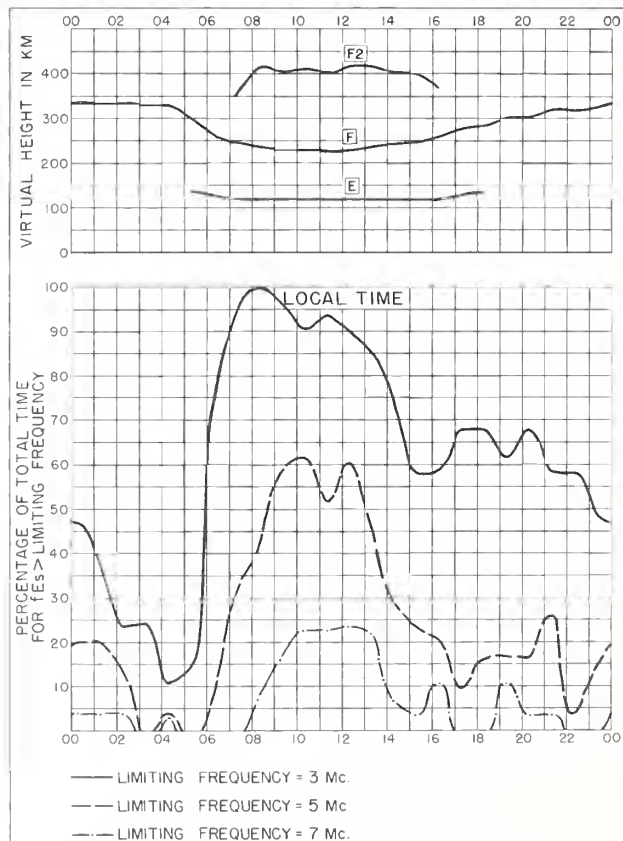


Fig. 112. BUDAPEST, HUNGARY AUGUST 1958

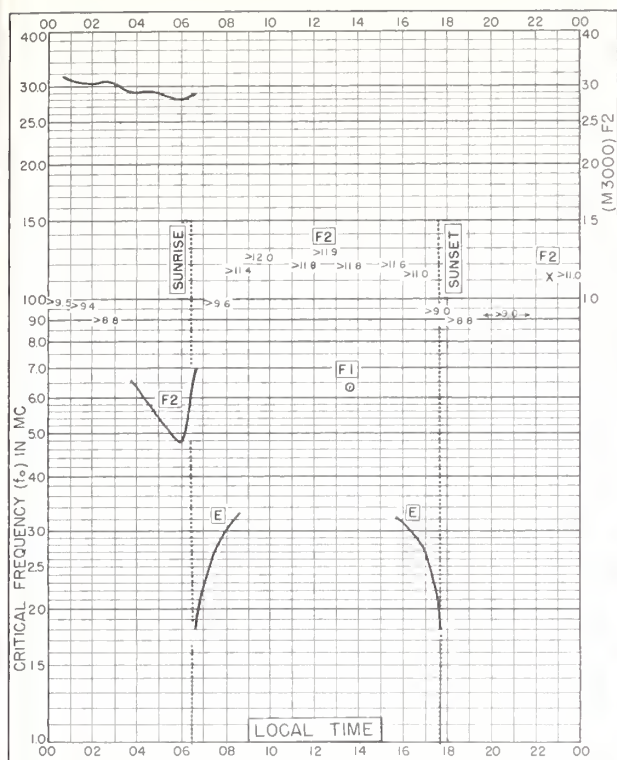


Fig. II3. La QUIACA, ARGENTINA
22.1°S, 65.6°W AUGUST 1958

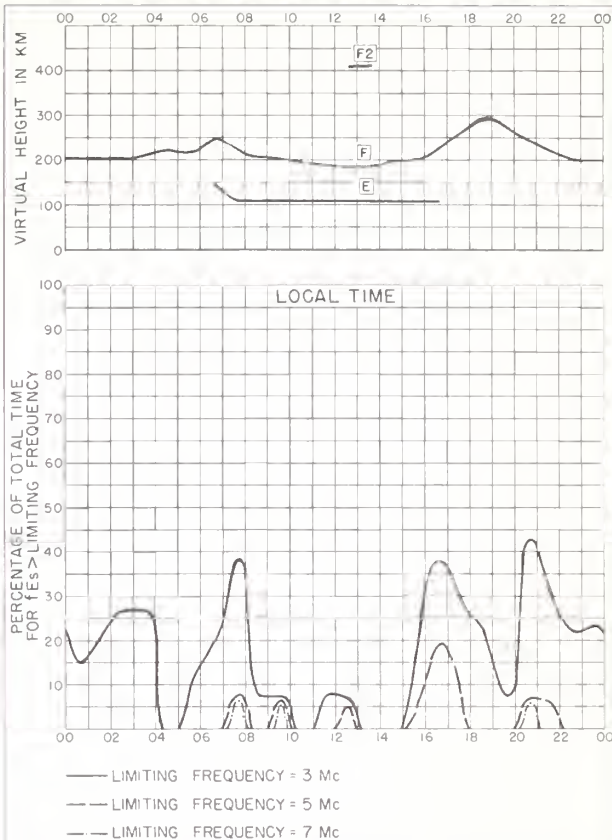


Fig. II4. La QUIACA, ARGENTINA AUGUST 1958

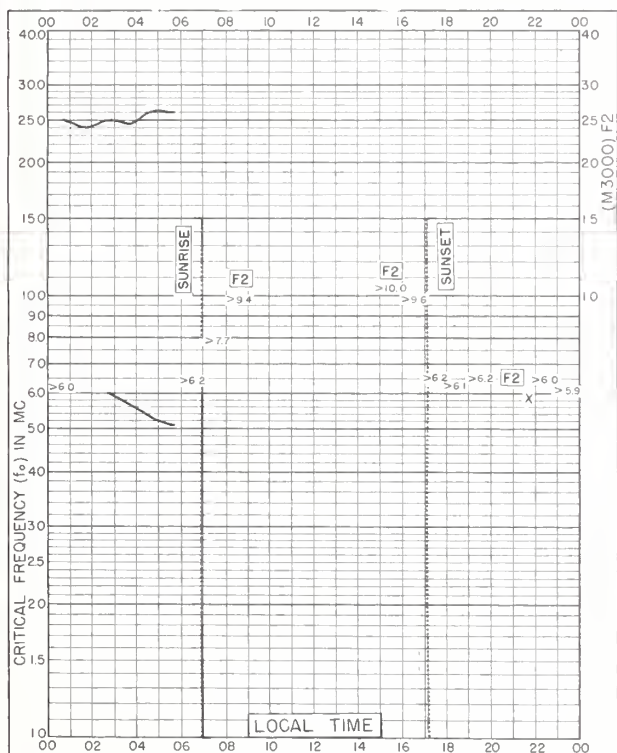


Fig. II5. TRELEW, ARGENTINA
43.0°S, 65.0°W AUGUST 1958

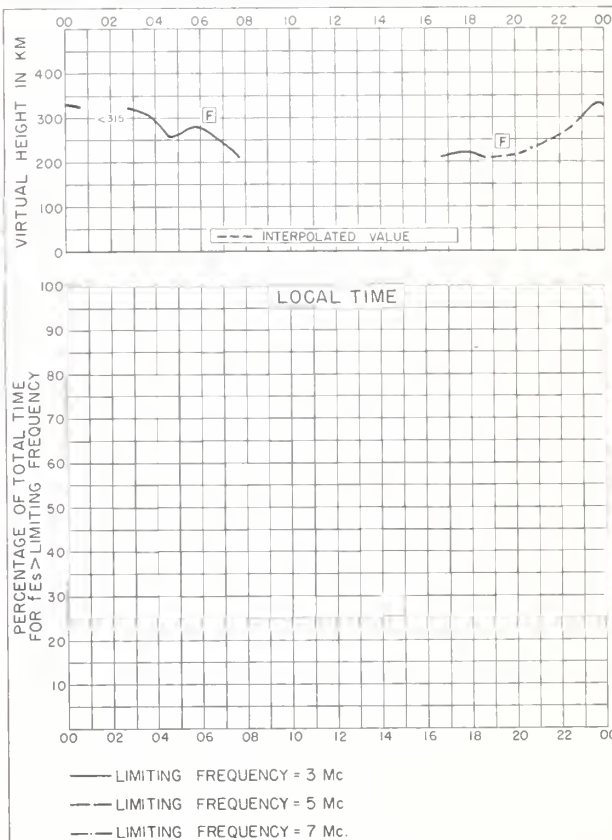
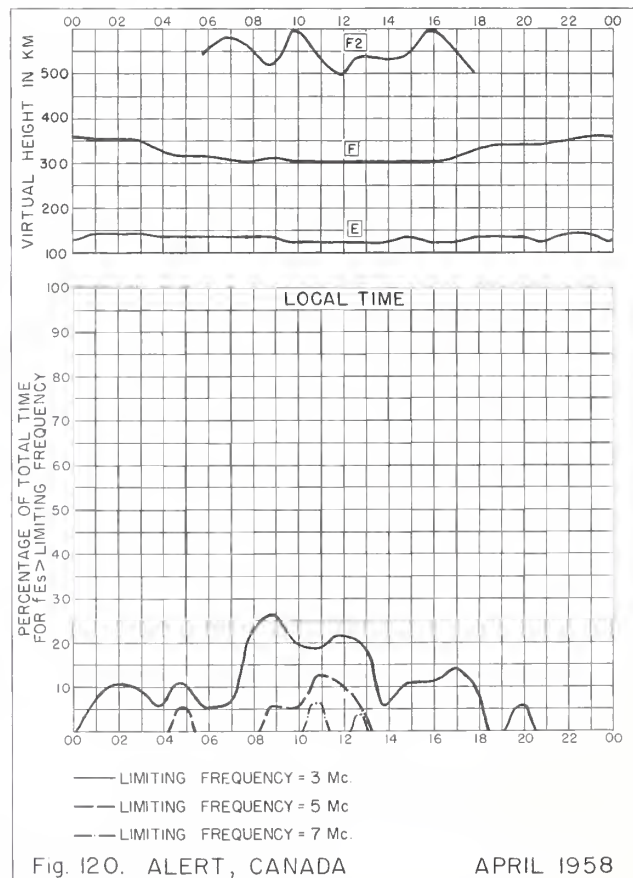
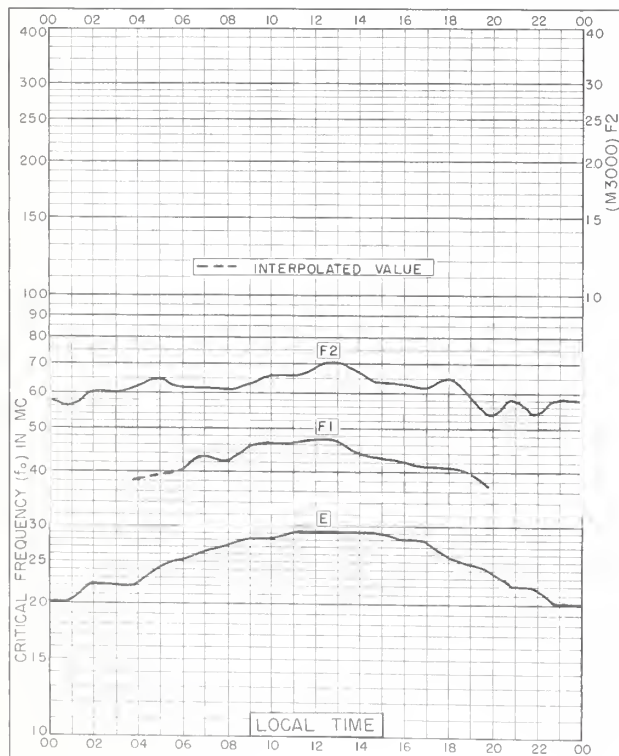
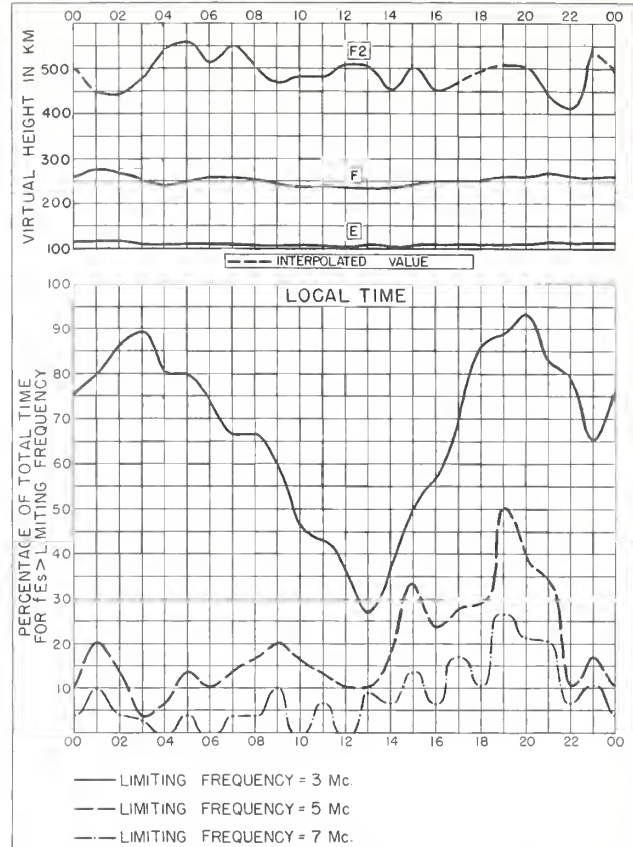
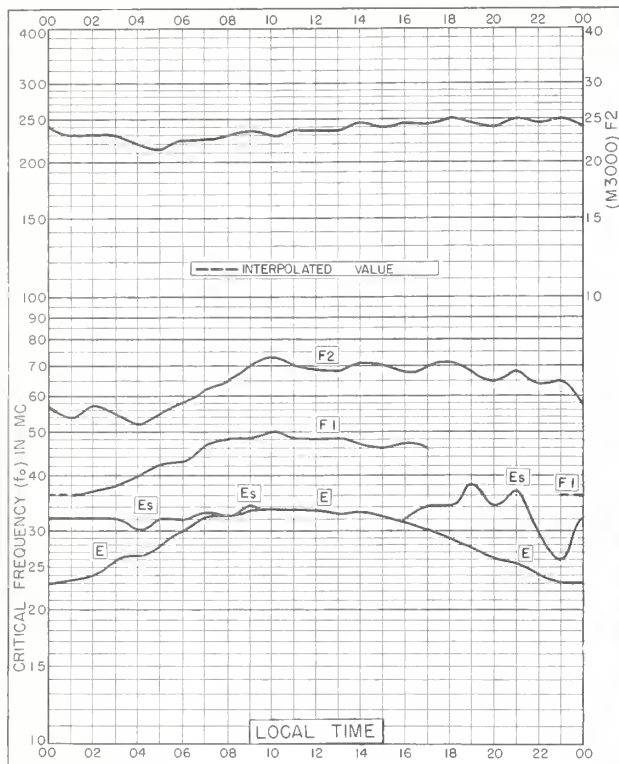


Fig. II6. TRELEW, ARGENTINA AUGUST 1958



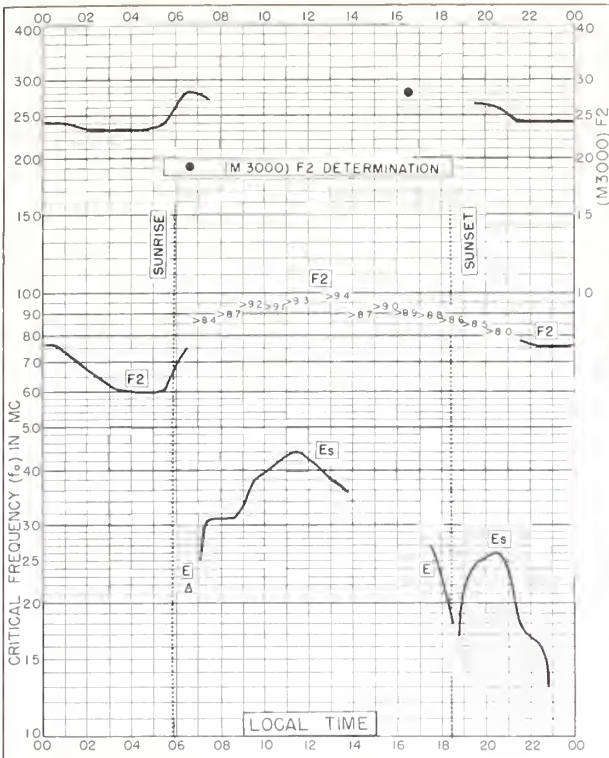


Fig. I21. USHUAIA , ARGENTINA
54.8°S , 68.3°W

MARCH 1958

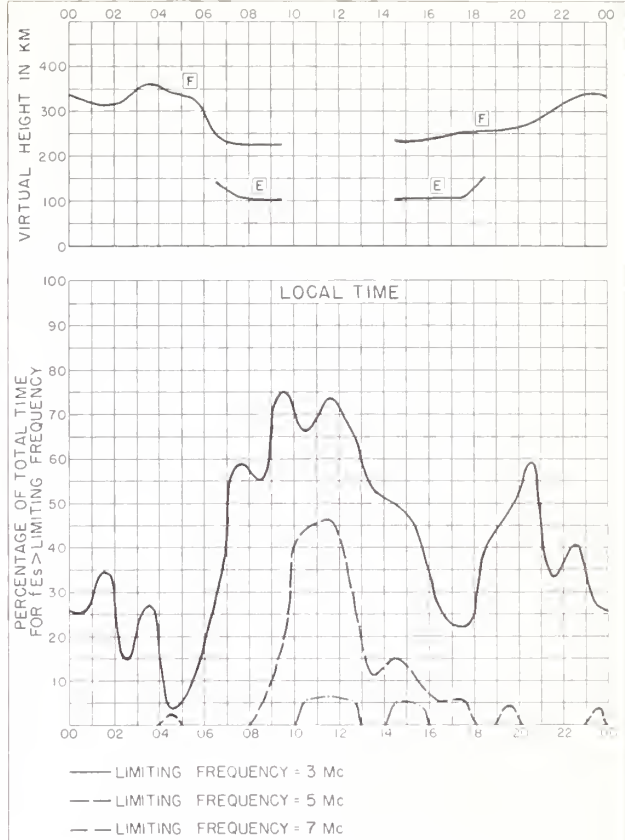


Fig. I22. USHUAIA , ARGENTINA

MARCH 1958

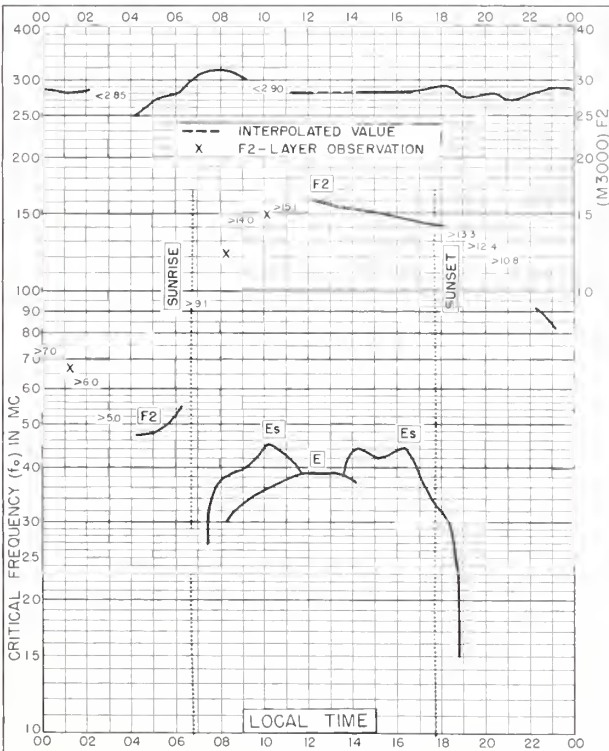


Fig. I23. DELHI , INDIA
28.6°N , 77.2°E

FEBRUARY 1958

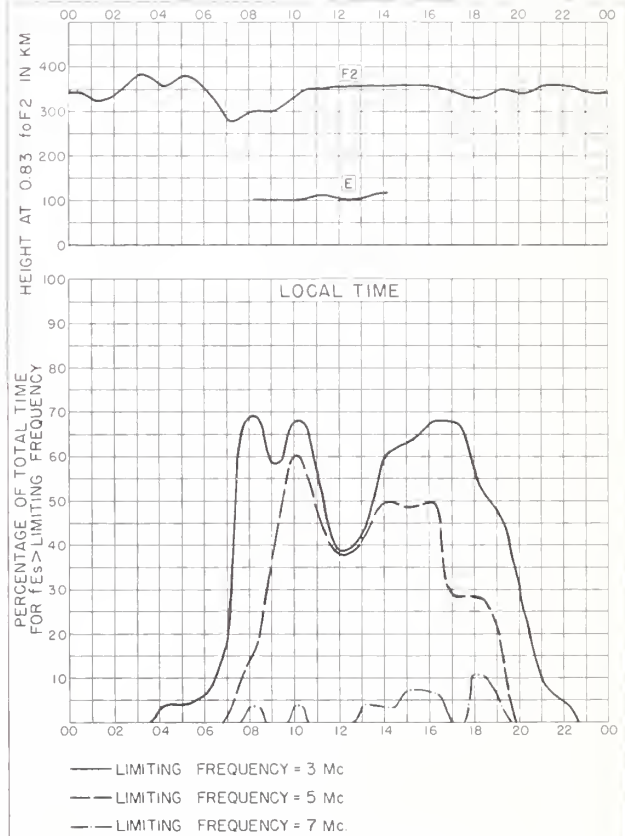
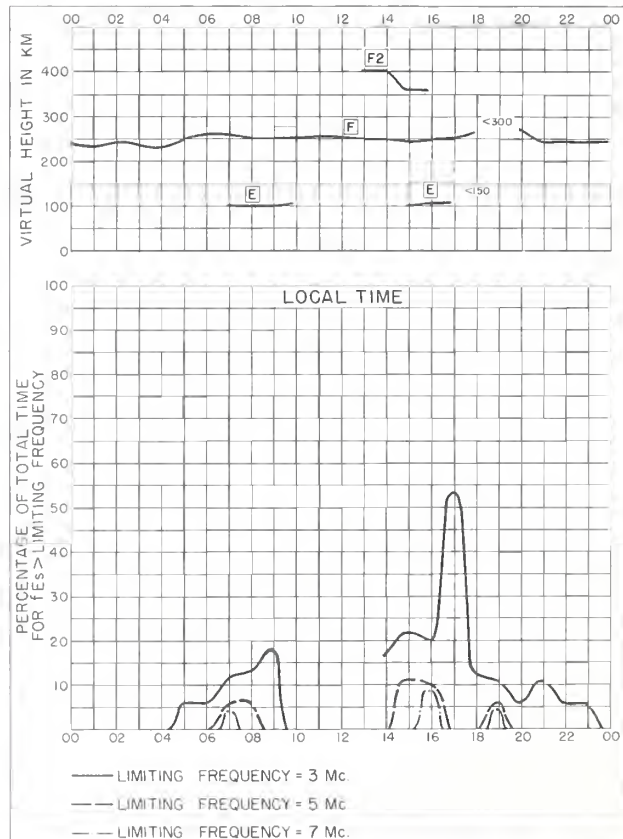
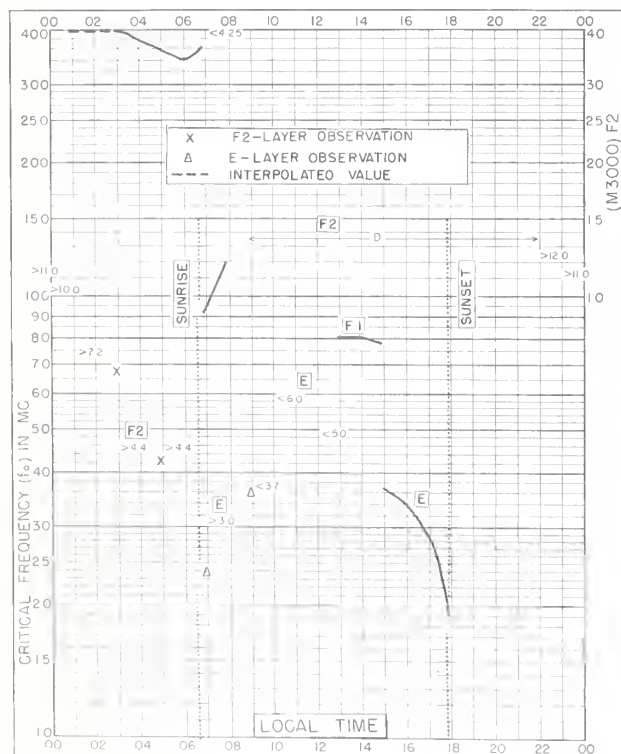
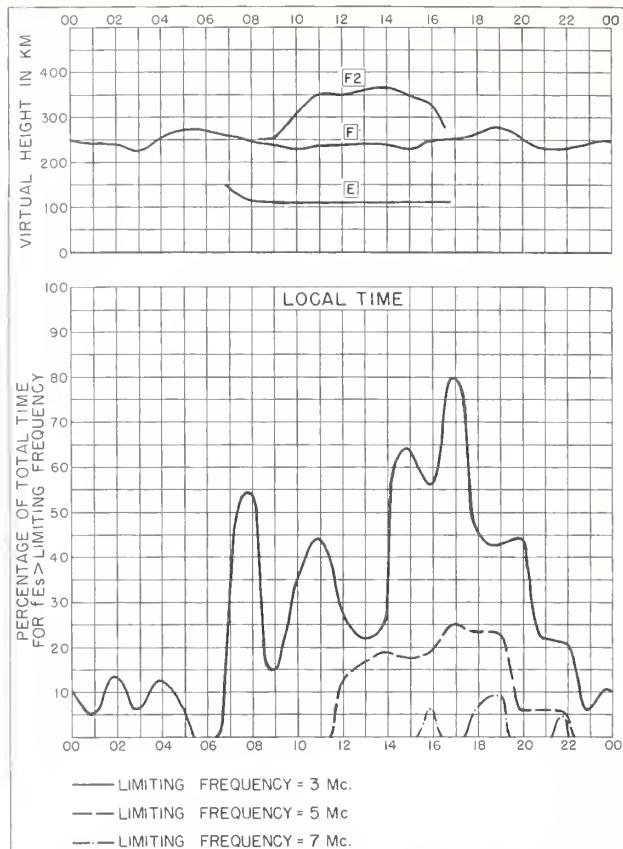
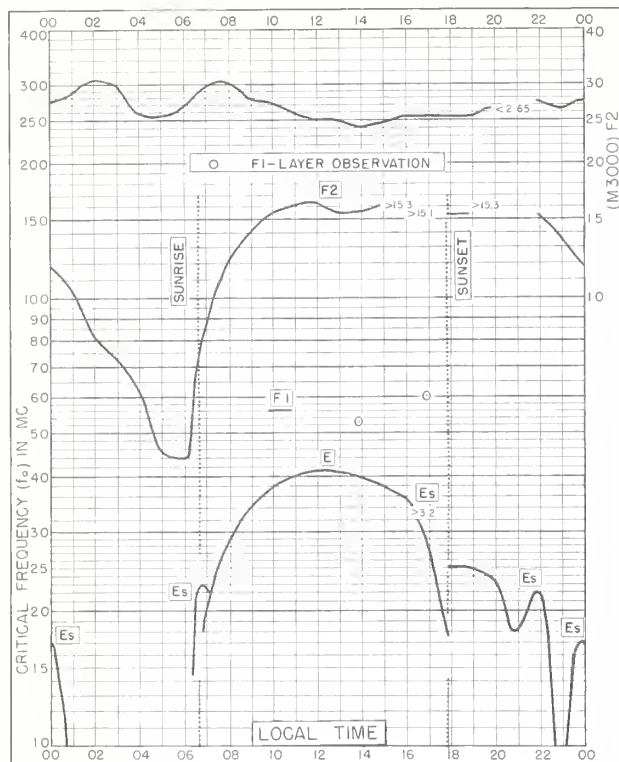


Fig. I24. DELHI , INDIA

FEBRUARY 1958



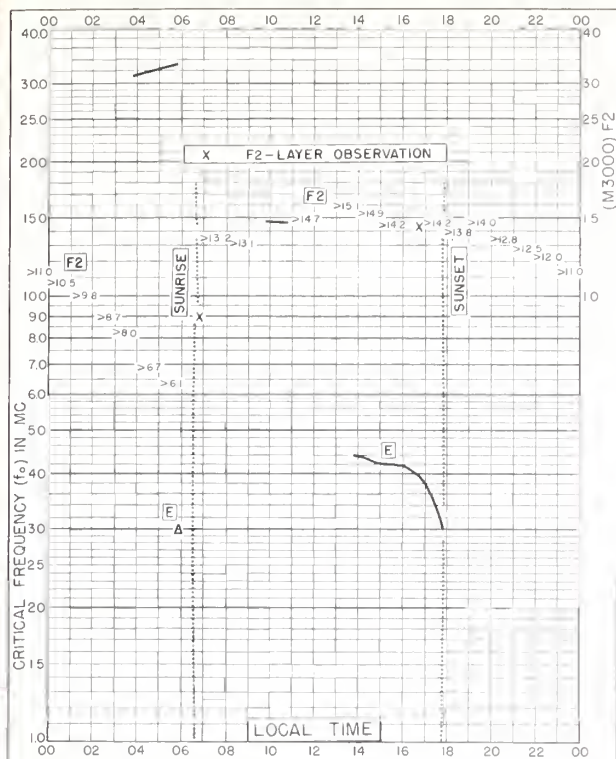


Fig. 129. BOMBAY, INDIA
19.0°N, 73.0°E FEBRUARY 1958

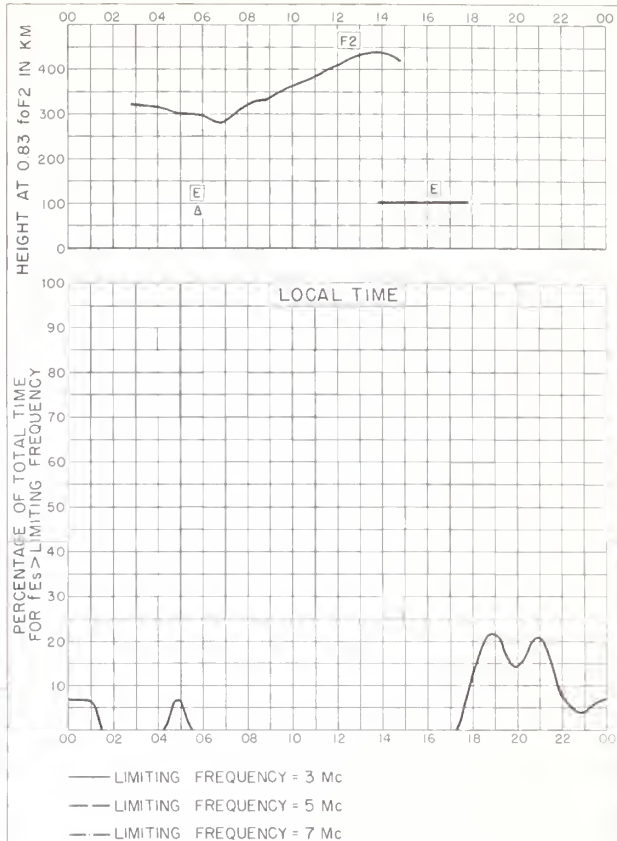


Fig. 130. BOMBAY, INDIA FEBRUARY 1958



Fig. 131. MADRAS, INDIA
13.1°N, 80.3°E FEBRUARY 1958

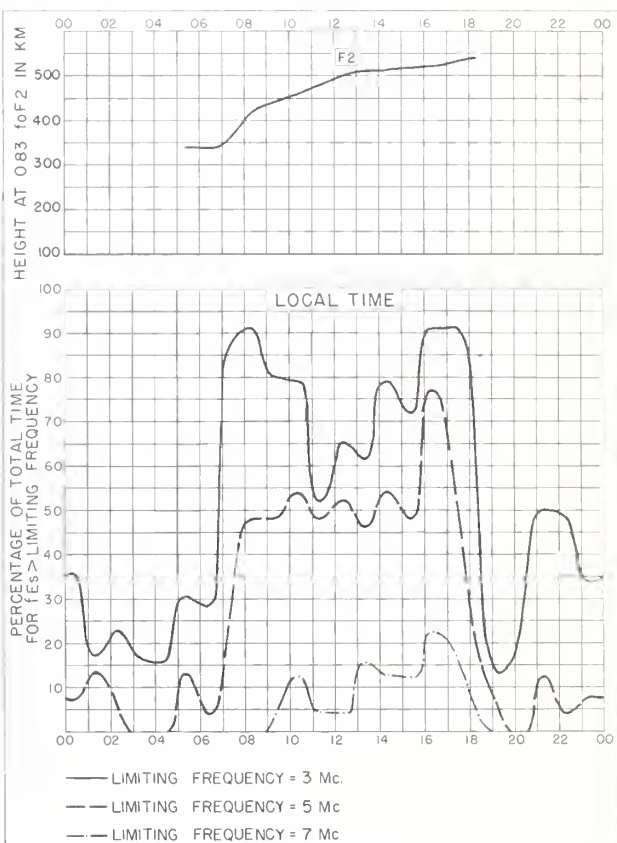
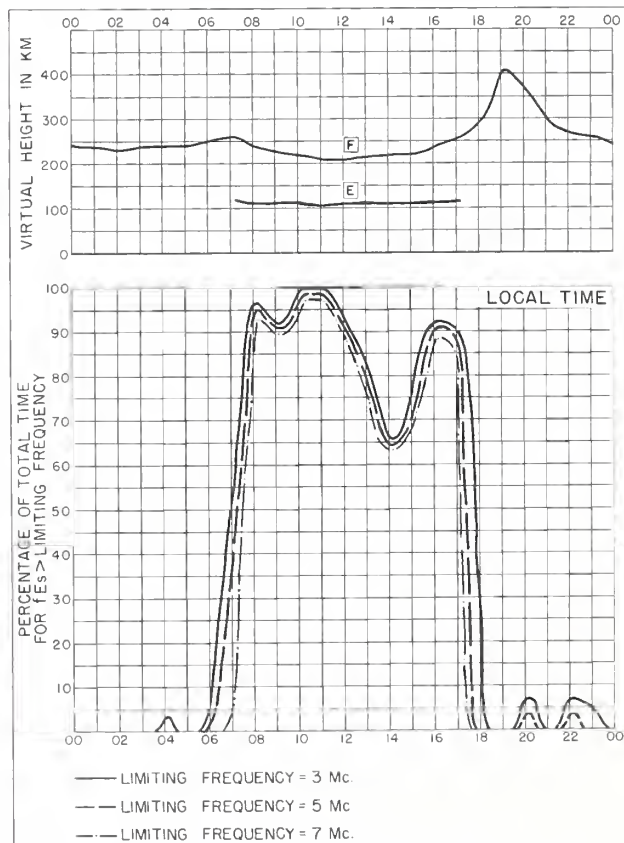
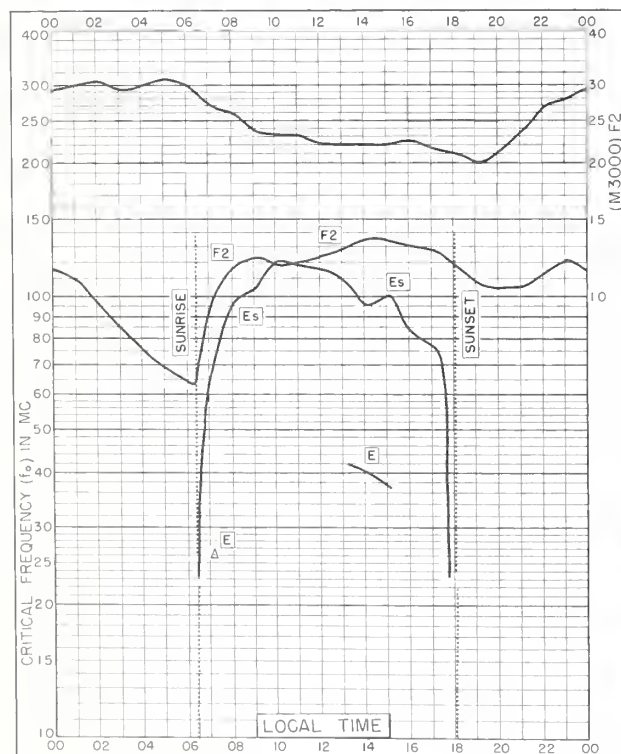
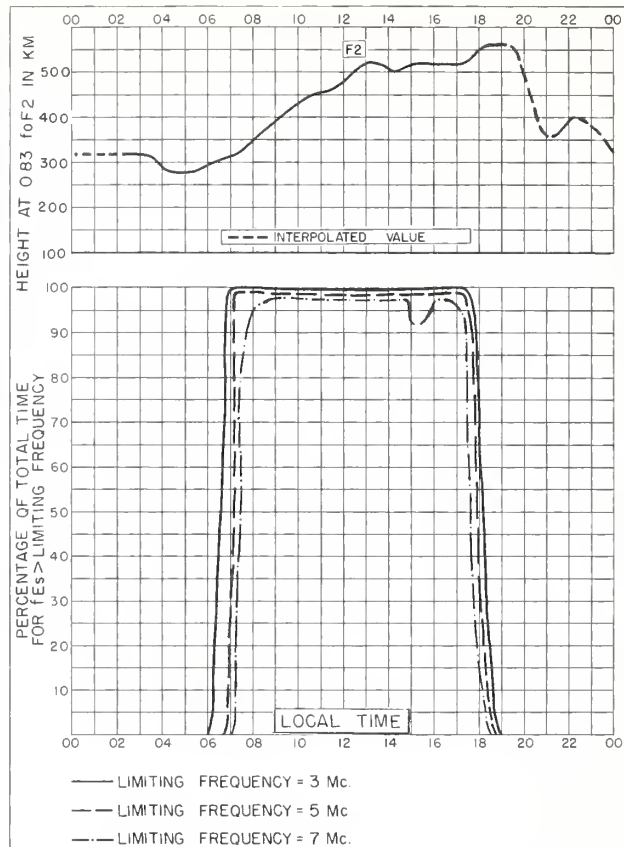
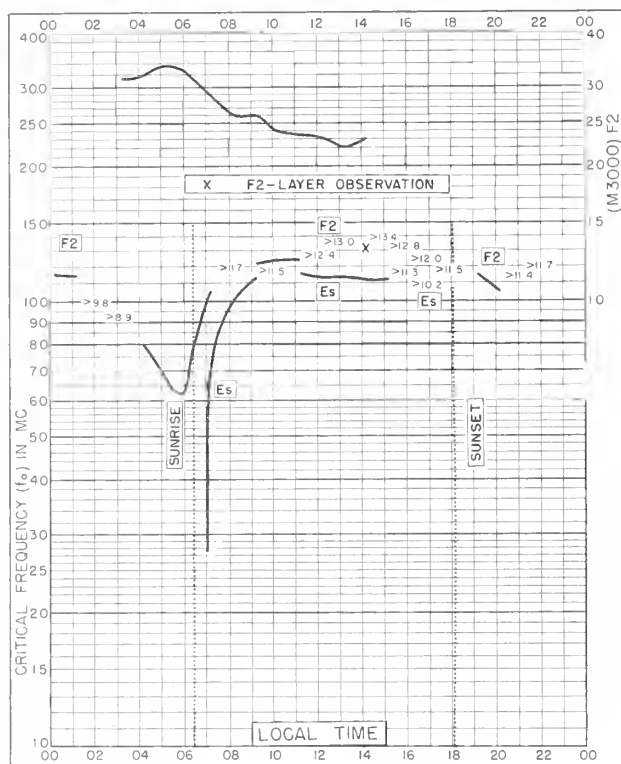
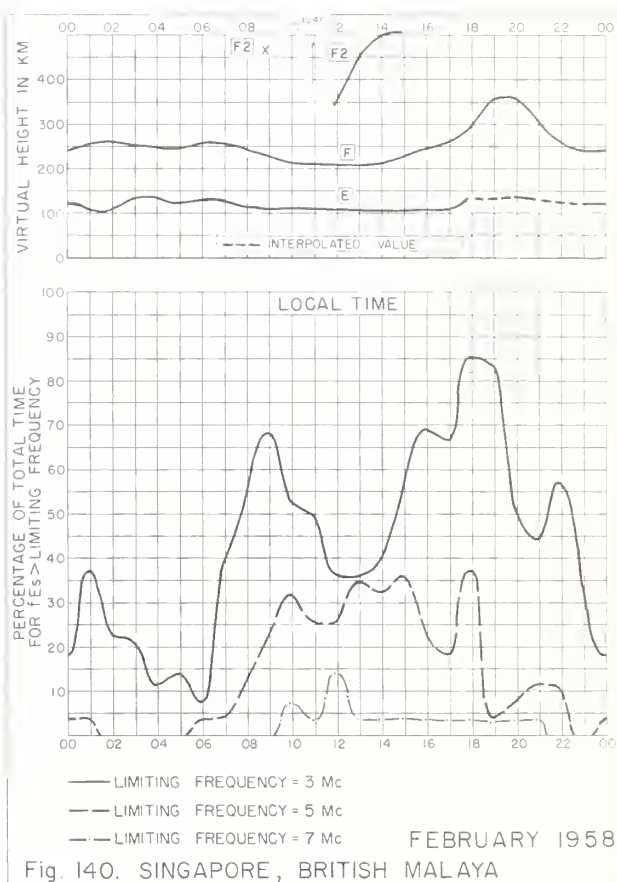
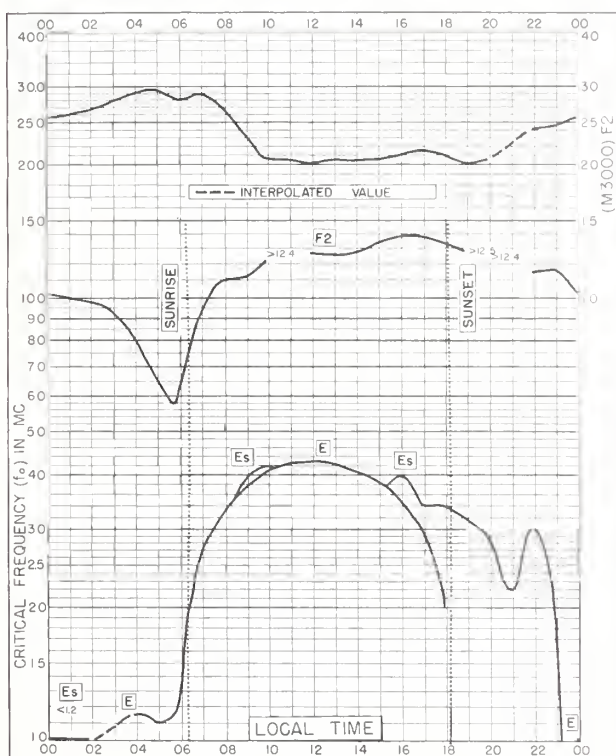
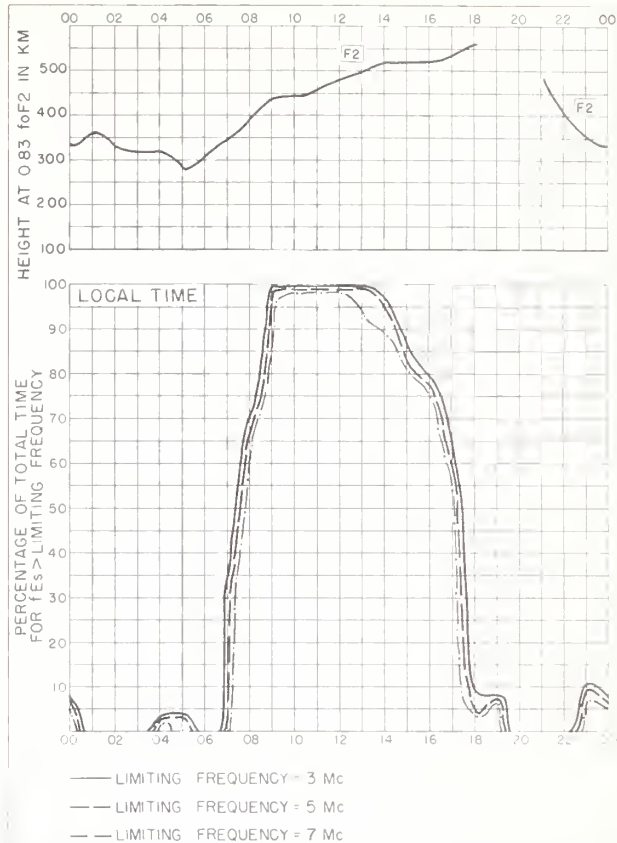
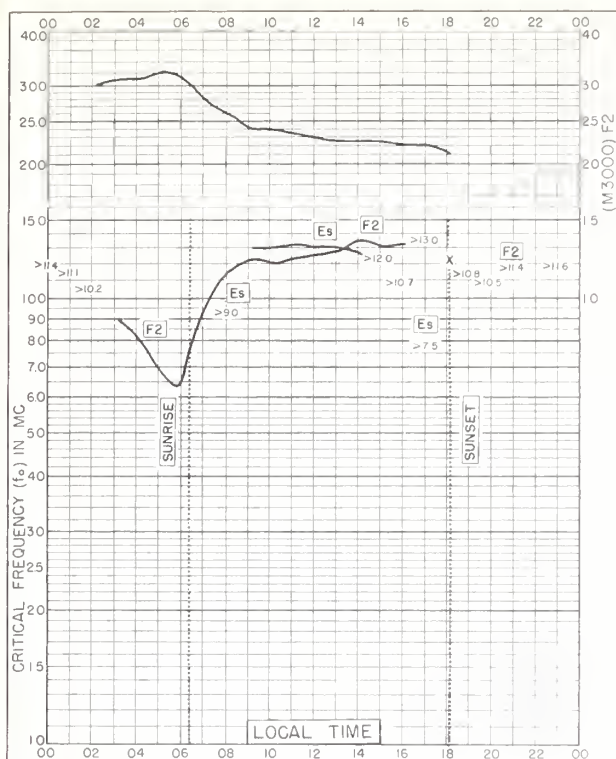


Fig. 132. MADRAS, INDIA FEBRUARY 1958





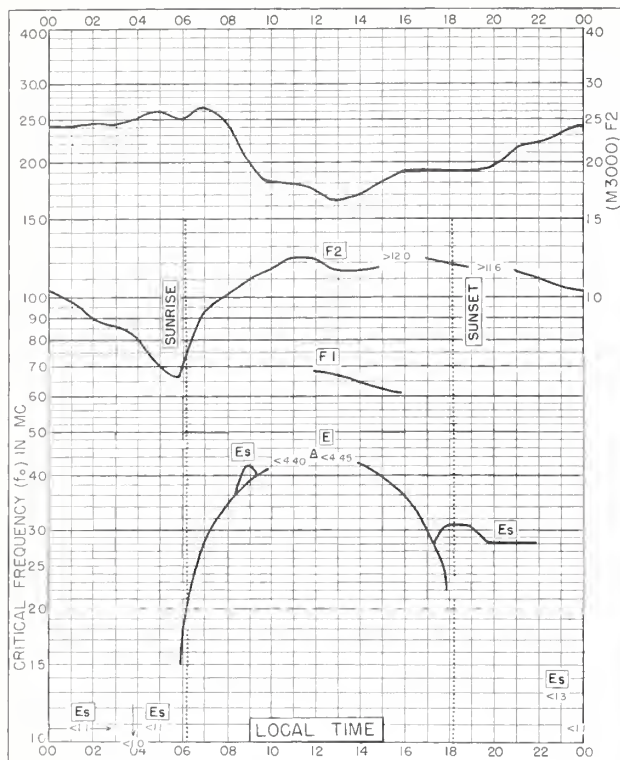


Fig. 141. SINGAPORE, BRITISH MALAYA
1.3°N, 103.8°E JANUARY 1958

NBS 503

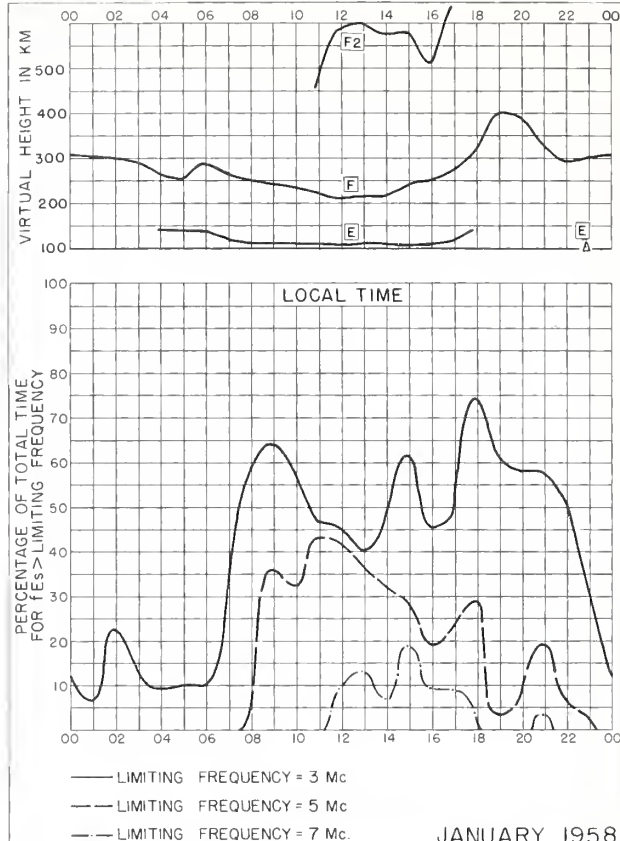


Fig. 142. SINGAPORE, BRITISH MALAYA

NBS 490



Fig. 143. ALERT, CANADA
82.5°N, 62.7°W AUGUST 1957

NBS 503

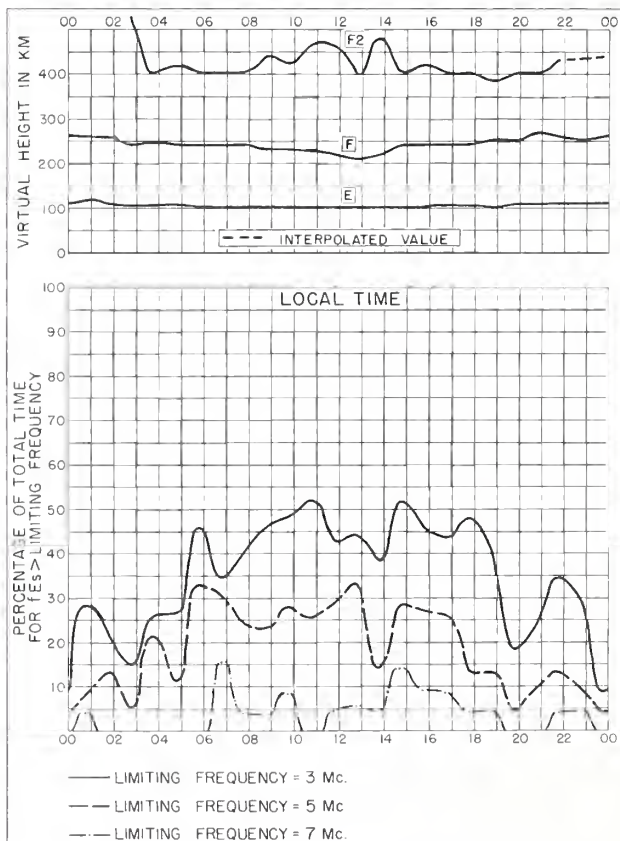


Fig. 144. ALERT, CANADA AUGUST 1957

NBS 490

Index of Tables and Graphs of Ionospheric Data

in CRPL-F191 (Part A)

	<u>Table page</u>	<u>Figure page</u>
Ahmedabad, India		
February 1958	11	44
Alert, Canada		
April 1958	10	42
August 1957	12	48
Bombay, India		
February 1958	11	45
Brisbane, Australia		
December 1959	3	21
Budapest, Hungary		
August 1958	10	40
Buenos Aires, Argentina		
December 1958	9	38
Bunia, Belgian Congo		
August 1959	6	28
Byrd Station		
February 1959	8	36
Calcutta, India		
February 1958	11	44
De Bilt, Holland		
December 1959	3	20
Delhi, India		
February 1958	11	43
El Cerillo, Mexico		
October 1959	4	23
September 1959	5	25
July 1959	7	32
Elisabethville, Belgian Congo		
August 1959	6	30
July 1959	7	33
Falkland Is.		
September 1959	5	26
July 1959	7	33
Formosa, China		
June 1959	8	35
Grand Bahama I.		
February 1960	2	16
January 1960	2	17
Huancayo, Peru		
March 1960	1	14
Ibadan, Nigeria		
December 1958	9	37
September 1958	9	39

Index (CRPL-F191 (Part A), continued)

	<u>Table page</u>	<u>Figure page</u>
Inverness, Scotland		
December 1959	3	19
Kodaikanal, India		
February 1958	12	46
La Quiaca, Argentina		
August 1958	10	41
Leopoldville, Belgian Congo		
August 1959	6	30
July 1959	7	32
Lulea, Sweden		
October 1959	4	22
Lwiro, Belgian Congo		
September 1959	5	26
August 1959	6	29
May 1959	8	36
Lycksele, Sweden		
October 1959	4	23
August 1959	5	27
Madras, India		
February 1958	11	45
Moscow, U.S.S.R.		
September 1959	4	24
August 1959	6	28
Narsarssuak, Greenland		
February 1960	1	15
Nurmijarvi, Finland		
September 1959	4	24
Okinawa I.		
February 1960	2	16
Pole Station		
January 1960	2	18
December 1959	3	21
November 1959	4	22
December 1958	9	39
Port Lockroy		
December 1958	9	38
Providenie Bay, U.S.S.R.		
July 1959	7	31
Resolute Bay, Canada		
December 1959	3	19
Simferopol		
July 1959	7	31
June 1959	8	34
May 1959	8	35

Index (CRPL-F191 (Part A), concluded)

	<u>Table page</u>	<u>Figure page</u>
Singapore, British Malaya		
September 1959	5	25
August 1959	6	29
February 1958	12	47
January 1958	12	48
Slough, England		
December 1959	3	20
Sodankyla, Finland		
June 1959	8	34
Svalbard, Norway		
May 1958	10	42
Talara, Peru		
February 1960	2	17
January 1960	2	18
Thule, Greenland		
February 1960	1	14
Tiruchy, India		
February 1958	12	46
Trelew, Argentina		
September 1958	10	40
August 1958	10	41
Trivandrum, India		
February 1958	12	47
Upsala, Sweden		
August 1959	5	27
Ushuaia, Argentina		
March 1958	11	43
Victoria, Canada		
December 1958	9	37
Washington, D. C.		
April 1960	1	13
March 1960	1	13
White Sands, New Mexico		
February 1960	1	15

CRPL Reports

[A detailed list of CRPL publications is available from the Central Radio Propagation Laboratory upon request]

Daily:

Radio disturbance forecasts, every half hour from broadcast stations WWV and WWVH of the National Bureau of Standards.

Telephoned and telegraphed reports of ionospheric, solar, geomagnetic, and radio propagation data.

Semiweekly:

CRPL—J. North Atlantic Radio Propagation Forecast (of days most likely to be disturbed during following month).

CRPL—Jp. North Pacific Radio Propagation Forecast (of days most likely to be disturbed during following month).

Semimonthly:

CRPL—Ja. Semimonthly Frequency Revision Factors For CRPL Basic Radio Propagation Prediction Reports.

Monthly:

CRPL—D. Basic Radio Propagation Predictions—Three months in advance. (Dept. of the Army, TB 11—499—, monthly supplements to TM 11—499; Dept. of the Air Force, TO 31—3—28 series). On sale by Superintendent of Documents.* Members of the Armed Forces should address cognizant military office.

CRPL—F. (Part A). Ionospheric Data.

(Part B). Solar-Geophysical Data.

Limited distribution. These publications are in general disseminated only to those individuals or scientific organizations which collaborate in the exchange of ionospheric, solar, geomagnetic, or other radio propagation data.

Catalog of Data:

A catalog of records and data on file at the U. S. IGY World Data Center A for Airglow and Ionosphere, Boulder Laboratories, National Bureau of Standards, which includes a fee schedule to cover the cost of supplying copies, is available upon request.

The publications listed above may be obtained without charge from the Central Radio Propagation Laboratory, National Bureau of Standards, Boulder Laboratories, Boulder, Colorado, unless otherwise indicated. Please note that the F series is not generally available.

Circulars of the National Bureau of Standards pertaining to Radio Sky Wave Transmission:

NBS Circular 462. Ionospheric Radio Propagation. \$1.25.

NBS Circular 465. Instructions for the Use of Basic Radio Propagation Predictions. 30 cents.

NBS Circular 557. Worldwide Radio Noise Levels Expected in the Frequency Band 10 Kilocycles to 100 Megacycles. 30 cents.

NBS Circular 582. Worldwide Occurrence of Sporadic E. \$3.25.

These Circulars are on sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Members of the Armed Forces should address the respective military office having cognizance of radio wave propagation.

* For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. Price 15 cents (single copy). Subscription price: \$1.50 a year; 50 cents additional for foreign mailing.

